Notes of

Lectures

upon

Chemistry

By

William Cullen M.D.

taken by

Benjamin Rush

Of the Nitrous Acid.

Nitrous Acid is only found in Common Nitre, and Nitrous Ammoniac, and it is extremely probable that it is never found in a Separate State, but in Consequence of the putrefaction of Animal & Vegitable Substances only. The common Matrix of it is the upper Stratum or Soil of the Ground, as far down as the Roots of Vegitables reach. But as the Acid of Nitre is obtained from Subjects always in Combination w^th^ Alkali we shall forbear saying any more concerning its Production till we treat of Neutral Salts. J

shall therefore confine myself at present to the means by which we may extricate it from Bodies in which it is present, & its different Properties when extricated.

It may be extracted from Nitre by Distillation w.th the Addition of pure Clay or brick Dust w.ch as we said before "by dividing the Aggregate present Union, and favour the Resolution" — the Reason assigned for the good Effects of Clay in the preceding Proposition is the true One, nor does it act as some Chemists have supposed by the Vitriolic Acid present, since Mr. Pott found y.e the Distillation succeeded as well w.th a Bole perfectly freed from any

saline matter: but y^e troublesome & expo-
-rative, and great Heat required has occa-
-sioned this practice to be generally deserted,
and the more commodious one of the
addition of Vitriolic Acid Alone, or com-
-bined w^th Iron in the form of green vitriol,
to be substituted in its Room. by this
means the Or is disengaged by Or from y^e
first Alkali, and must be immediately
dissipated before it can be combined w^th
the Iron or Earth if vitriol or Alum are used.
M^r Jacquin gives all the necessary Directions
for this Process. I shall only remark the
erroneous Opinion of some, who direct y^e
Water should be added in the Distillation to

prevent the escape of Fumes, for y^e^ Fumes of water are more Elastic than those of the Acid. - This Practice is only fit for large Works. The Distillation is performed with less Heat, and more Convenience to the private Chemist when Vitriol. Acid is used alone. The Nitre must first be reduced to powder. Some have advised this to be done by means of Calcination, that the Water contained in the Crystals of the Nitre may be dissipated, but y^e^ Fumes of such calcined Acid are very difficult to be managed. To this powder must be added Vitriolic Acid, tho' y^e^ proper proportion remains still a Dispute. The general Rule is to add one part of Vitriolic Acid to

two parts of Nitre. Dr. Lewis observes y: w:
this proportion the Residuum is a mass not
soluble in water, and therefore difficulty
cleansed from the Retort. The London College
directs three parts of Nitre to one of Oil, by
this means we not only get y^e Nitrous
Acid, but a Residuum which is a Nitre:
Tartar. But if we are not anxious to
preserve the Residuum I think the former
proportion may be employed as it more
easily calcinates the Nitrous Acid. When
we have prepared the Nitre it must be
put into a Retort, and the Lutings suf-
fered to be quite dry before we apply the
Fire. The Heat must be very gradually

encreased 'till the whole is in Fusion, & must be continued 'till Fumes cease to rise. After the Process is finished we must suffer the Vessels to cool, before we open them, because they are filled w: uncon- -densed Fumes for a long time after the Operation is over, w: would escape if they were not immediately closed; the sudden Ad- -mission of Air also frequently breaks the distilling Vessels. The Nitrous Acid thus Obtained is usually mixed w: some Or w: rises in Distillation, and w: a portion of the muriatic Acid proceding from y common Salt always present in Nitre, and decomposed also by the Vitriolic Acid. It

may be seperated from the vitriolic by Co=
-hobation, and from q: Muriatic by a
Solution of Silver in Nitrous Acid to which
the former has the greatest Affinity. It is
a Law that when Nitrous Acid is in hugna=
-ted w: Vitriolic and Muriatic Acid, they may
be precipitated in form of White Clouds
by the Addition of a Solution of Silver. thus
the Trouble of two Operations is prevented.

This Acid when concentrated sends out
reddish Fumes, and is of a light Orange
Colour. the Colour however varies accord:
to the different matter w: it is combined
in an impure state. thus Distillation w:
green Vitriol produces an Acid differing
from the ~~green~~ orange Colour, and w: White

Nitrick a corrosive Liquor. Mr Ruelle
After 5 Days labour obtained a nitrous
Acid whose Specific gravity was to y.t of
water as 15 to 10. but when its Specific
gravity is as 14 to 10 it is sufficiently
concentrated for any purpose I am
acquainted with. in this State we ought
to preserve it for use, since it is more
easy to dilute a concentrated Acid for
purposes w.ch require it, as the Solution
of Silver than to concentrate a dilute
Acid for the purpose w.ch require it in
that State. Such is the Inflamation
of Bile. this Acid when very dilute is of
a green Colour, w.ch may be entirely dis-
-charged by the addition of pure Silver.

If the green Colour or any Other takes place after the Addition of the Silver. we may be certain that the Silver contains Copper or some foreign matters Adhering to it.
If Nitrous Acid is much diluted, & subjected to Distillation, the Result will be an Acid giving no Fumes.

Let us now consider its Relation to other Bodies beginning w:th ye Saline.
It unites w:th the Saline producing Effervescence & Heat. its union w: the Alkalies is attended w: ye same Phenomena as the Vitriolic. its power of Saturation and Attraction is considerably less. and the neutrals produced entirely different. one ℥i of fixt Alkali saturates ℥ij + of Nitrous

Acid, whereas the same Quantity satu-
-rates only ℥ij of Vitriolic.

It unites ℔ij w: all Inflammables. gen-
-erating Heat and Effervescence, except w:
Sulphur with which it seems to refuse
all union. in the 16th Century it was
found y: a sudden Mixture of Oil &
Spirit of Nitre produced actual Flame.
The Experiment was long neglected 'till
Dr. Hoffman revived it, and found y all
the distilled and most of the expressed Oils
might be inflamed by the Assistance of
Nitrous Acid. from later Experiments
we are informed that all y Oils un-
-der a certain Management might

be inflamed by the Nitrous Acid alone.

It unites w: Alcohol producing a Spirit of Ether.

It unites w: all Metallic Bodies except Gold, and perhaps Platina. Tin & Antimony it only corrodes, but suspends the Ether in a fluid Form.

It unites w: Absorbent Earth of every kind.

It unites w: water producing Heat, but w: Ice it produces Excessive Cold. we may produce a greater artificial Cold by this Acid than any other Body.

It attracts Moisture from the Air. we are ignorant of its further Effects upon this Fluid.

It has the same Effects on the Vitriolic

bird upon Animal and Vegitable Sub-
-stances only in a less Degree.

When combined w^th^ Alkalies or Metals
it deflagrates in Contact w^th^ y^e Fire.

Of the Muriatic Acid.

It is a Native Substance, & whether
it may not be produced by Art is much
to be doubted. It is always found either
combined into Common Salt, or common
Ammoniac. In the first of these every
Person will acknowledge it to be a Na-
-tural Substance, but as the common
Ammoniac is never found except in
Consequence of Inflamation, it has

been reckoned by some, & perhaps not unjustly an artificial substance.

This Acid is chiefly distilled from Common Salt as it is cheaper than Ammoniacus not that there is any Difference in the Acid Obtained from either Subject. the Distillation must be performed by the addition of pure Vitriolic Acid, or some of its Connexions with Earth. we cannot employ crude Vitriol as in the Case of Nitre, because the Iron becoming volatile from a particular power which the Muriatic Acid exerts towards some Metals, will rise into the Receiver, and intermix the product. it is as yet unsuspected that this Acid renders Calcarious Earths volatile. I think therefore that the

Vitriolic Acid should always be employed
in its Seperate State. a portion of the
Acid will inevitably rise in the Distillation
but we may extricate it perfectly by the
addition of Calcarious Earth w: h: of Vitriolic
Acid only corrodes, and will therefore
subside w: it in the form of powder. the
ment are very firm and accurate Luting
giving them time to dry before the Ope-
-ration, since the Fumes of this Acid
are scarcely to be confined by any Ma-
-nagument except by a large Addition
of water, which we cannot employ when
we require a very concentrated Acid. we
may determine when the Distillation is

sufficiently advanced by ꝯ Appearance of deep yellow Fumes, and Air Bubbles on the Surface. its Specific Gravity however is a more invariable Rule, which in its purest State is to ꝯ of Water as 12 to 10. In this State it is of a Gold Colour emitting copious Fumes ℞ w: Outside when it is very much diluted ℞ w: water. we shall next mention its Affinity to ꝯ other Classes of Bodies.

It unites ℞ w: all Saline Bodies ℞ w: the same Phaenomena as the Nitrous and Vitriolic, and produces ℞ w: Alkali diff.ly Neutrals. from this it may be expelled by either of the former Acids. ℥i of fixt Alkali saturates ℥xxi of this Acid.

It does not unite w: Oils. This is probably owing to the great Quantity of Water it contains even in its most concentrated State. it may be united w: Alkohol tho' imperfectly to produce Æther. it has no Effect upon Sulphur. It unites with all metallic Bodies except Gold. Copper Iron Zinc & Tin it suspends in a fluid Form. Quicksilver & Antimony it does not readily dissolve in the Cold. Lead Silver & Bism: it only corrodes.

It unites w: all Absorbent Earths suspending them in a fluid Form, whereas the Vitriolic only corrodes them

— The w: the Calcarious it forms a noted Salt called fixt Ammoniac. The latter of these names is taken from its being obtained by Distillation w: the common Ammoniac, and the former from its Fixity, w: is a property not applicable to any of the other ammoniacal Salts.

It unites w: water, and purchases air like the ~~Neutral Salts~~. Nitrous & Vitriolic Acid.

It dissolves Animal, and Vegitable Bodies, but by not dissolving Oils it does not change their Colour to black. on this Acc: it is much employed by Anatomists in making preparations of injected wax.

for when the Acid is applied it entirely
dissolves the Flesh, and leaves ye Wax in
the exact Shape of the part injected.

We think it proper here to mention
a very peculiar Menstruum formed
of the Nitrous and Muriatic Acids viz.
from its power in dissolving ye Rex
Metallorum Gold has been called
Aqua Regia. It may be produced
by adding two parts of Nitrous to 1 of
Muriatic Acid or vice versa. This Diffe-
rence of proportions occasions no Chang
in the Properties of the Mixture. it may
also be produced by adding one part of
common Salt to 4 parts of Nitrous Aci

It may also be obtained by adding Muria-
-tic Acid to common Nitre. This will ap-
-pear a paradox to many according to
the Laws of Elective Attraction, but may easily
accounts for it upon rational and
obvious principles. he observes 2ly: the
Practice will not succeed except in a
very considerable Heat, when a Suffici-
-ent Quantity of Nitrous Acid to form an
Aqua Regia will be decompos'd & raised
w: the Muriatic. It acts upon most
Bodies nearly in the same Manner as
the Acids which compose it, only it is a
much more powerful Menstruum for
all Metals. we are naturally led hence to

enquire w^h are the Effects of other Acids com-
-bined? It is to be suspected since we see
such remarkable Effects of their Combi-
-nation in dissolving and inflaming
Oils, that important Discoveries might
arise from such Inquiries.

Of Vegitable Acids

They are native Substances found uni-
-versally in Vegitables, and perhaps in
Vegitables only. D^r Boerhaave enu-
-merates 5 kinds of this Acid, but I
think they may very properly be
reduced to 3. viz: the native, the
Fermentive, and the Distilled.

Native Acid is Obtained from vegitables as Lemons by simple Expression. In this State it is so very dilute, that if kept for any long time it would run into a putre=faction Fermentation. this however may be obviated by Rectification, After which it is called Rob. The general Rule directs us to evaporate till the Substance is of the Consistence of a Syrup. but the process cannot be extended so far, without changing the peculiar Flavour of the Acid. we may remedy this by evaporating less of the water, and by the Addition of Alkohol which w:^ch is extremely convenient not only as an Antizymmic to prevent Fermen=tation, but as it is always mingled w:^th

Rot for the usual purposes of our Economy.

Fermentive Acid.

We shall omit saying anything concerning the production of this Acid, till we treat of the general Theory of Fermentation under the Head of Alkohol. —

This Acid is always considerably diluted with water. it may be rendered more concentrated by Distillation, as directed in Macquer: but this practise will not sufficiently dispel the water without giving the Acid such an Empireuma as renders it unfit for any Economical

uses. Another Method has been proposed of combining the Acid w:th a Metal in form of a Salt, and then distilling from the Crystals. but even y^e few Metals y:^t can be combined w:^th the vegitable Acid, make this proposal of but little use. for Example, if it is combined w:^th Lead into a Saccharum Saturnii, and subjected to a Distillation, instead of a concentrated Acid, we shall get an Ardent Spirit. Iron also changes the Acid. Zinc will not dismiss it without a great deal of Heat. when combined with Copper into Verdigris it may be obtained very much concen: -trated, but then it cannot be used w:^th Safety for medicinal purposes, upon ha:^t

of the deliterious Effects of the Copper or Zinc, some of whose particles we cannot prevent by any precaution from rising w: the Air in Distillation.

After repeated Experiments we think the best Method to accomplish this Desideratum of the Chemists is to expose the Vinegar to Cold 8, or 10 Degrees below the freezing point, carefully taking off the Pellicles of Ice which form upon the Surface. These Pellicles contain chiefly water. by this Method I have reduced four pints to half a pint, and in colder Climates it may be practised w: greater Advantage. The Practice will not be successful when

the Cold does not descend to 22° or 12°
below the freezing point.

One Ounce of Vegitable fixt Alkali
saturate 3viii of vinegar. This Combinⁿ
produces About two Ounces of Regenerated
Tartar, from which we may Obtain in
Distillation a very concentrated Vegitable
Acid by the Addition of the Vitriolic.
The portion of the latter wᶜʰ necessarily
arises in Distillation May be extricated
by Redistillation wᵗʰ a fresh portion
of Vitriolic Acid.

Distilled Acid

Is Obtained from the Distillation of
Vegitables &c. The Tin contains

this acid in great abundance, and that
is generally employed in the following
manner. The Retort is filled w.th Chip
of the Fir, and a sand heat applied gra
-dation. in the first part of the Distillat
a water arises, after that an acid then
an Oil w.ch is the Essential Oil of the Fir,
Lastly an Empireumatic Oil resembling
Tar. These Oils being separated by the
means employed under the Head of Sepa
-ration, the acid must be concentrated
by a second Distillation. This B is the
same acid as that procured in Tar wa
and contains all its Medical properties

Dr. Berkly Bishop of Cloyne who is a strong Advocate for the Virtues of Tarwater directs us to use Norway Tar rather than American. the Cause of this prefe-rence is not on Acc.t of any peculiar Quality in the former, but from y.e Quanti-ty of Water w.ch w.ch the Norwegians Adulte-rate it. Whereas the Americans are allowed a Bounty for the Importation of Tar as free as possible from water & Impurities of all kinds.

The Production of Tartar which is a vegitable Acid shall be considered under the Head of Vinous Fermentation.

Properties of vegitab:e Acids.

There is some variation in the Relation

of these several Species to be established as
to other Bodies, tho' they are not dis-
-tinctly ascertained by Experiment.
This Acid unites w: Acids - and w: Alkalis
forming Neutrals w: the latter, with
this Difference from the other Acids, that
no Effervescence succeeds the first Addi-
-tion, but as the Mixture approaches to
Saturation the Effervescence encreases.
It admits of no Union w: Inflamma-
-ble except Ardent Spirits, w: which in
a very concentrated State it may be in-
-timately combined.
It unites w: several Metallic Bod-

as Copper, Lead Zinc, and as Dr Lewis & Mr Margraaf inform us in a very small proportion w: Tin. it corrodes Iron and Antimony, and indeed there are few Metal: Substances w: may not be dissolved by Vegitable Acid if applied after Precipitation from other Acids.

It may be combined w: all Vegitable Acids and are Soluble in other Acids

When highly concentrated it generates Heat with water and Cold w: Ice.

It acts upon Animal & Vegitable Substances as a powerful Antiseptic and renders Animal Fluids less coagulable,

Whereas the Other Acids very much pro-
-mote their Coagulation. This Circum-
-stance perhaps depends more upon the
Redundance of the water with which
this Acid is always diluted, even in its
most concentrated State, than upon
any peculiar Property of the Acid.

Of Acids in general.

All Acids retain their Fluidity more
strongly than water, tho' in certain De-
-grees of Cold they may be rendered solid.
The more any Acid is concentrated the mo-
-re its freezing point increases. Acids when
quite pure are of much greater Specific

Gravity than water. this however is di:
=minished in proportion to the quantity of
water present, so that probably if we could
obtain them perfectly free from foreign
matter, their Specific gravities would be
equal. In ~~the~~ acids also of equal Degree
of purity neither the Colour Taste nor Odour
can be distinguished, but sementorily
to depend upon extraneous matter.
These Facts are favourable to the Opinion
of some who think there is but one prima
=genial Acid in Nature.

It is the general property of all Acids
to unite with Alkalies forming Neutral
Salts wch possess the properties of neither

simple Ingredients before mixture.
Acids join with Alkalies producing
Heat except when very much diluted.
at w.ch State they generate Cold with mild
volatile Alkali. The Reason of this perhaps
is That the Cold generated by y.e Alkali by
water exceeds the Heat generated by y.e Acid
& Alkali. The different Acids require
different proportions of Alkali for their
Saturation. Mr Homberg has endeavoured
to ascertain these proportions, yet his Ex-
periments for this purpose are very inac-
curate. First because he determines the
power of Saturation by the additional
Weight of the Alkali after mixture,

without considering that the Acid supplies
also the Weight of the fixt Air which es-
-capes in Consequence of the Union. a
second Objection to his Experiments is,
that he examined the Salts in Crystals,
which we shall prove to contain a large
proportion of Water. we can however
w:th Certainty affirm that y:e Acids re-
-quire more or less of Alkali for their
Saturation.
The ⊕r and ⊖r unite w:th all y:e Oils ex-
-cept the Presence of some foreign Matter
prevents the Combination. hence proba-
-bly the Reason why the Muriatic and
Vegetable Acids do not dissolve Oils be-
-cause

we never can obtain them but in a very dilute State. we are somewhat confirmed in this Opinion, since the Nitrous and Oxigenated Acids may be entirely deprived of their power to dissolve Oils by a proper Dilution w: water. The Ox and Ox also unite w: Alcohol, but if considerably diluted they become as incapable of such an union as the Muriatic or Sulphur. — Some of the Acids unite w: Sulphur all Metal. Substances may be dissolved by the Acids either seperately applied, or in Combination w: each Other. The Effects of Acids upon M S: do

extremely opposite. 2.9: The Vitriolic Acid will not dissolve Copper except in a highly concentrated State, whereas it will not dissolve Iron except in a very dilute State.

all the Acids unite w: every Species of Absorbent Earths.

When highly concentrated they all attract water from the dryest Air.

Acids dissolve all or some of the Ingredients in every Animal & Vegetable Substance destroying their Texture & changing their Colour more or less to a black. They are very powerful Antiseptics, and coagulate most of the Animal Fluids.

From this comparative & general view of the Acids we are led to conclude y^e the Opinion of some is not improbable who suppose that there is but one pri=mogenial Acid in Nature, and y^t y^e differen Species which we can examine are no=thing more than various modifications of this Acid with foreign Matters - we have never been able as yet to discover the Substances which produce y^e different Acids. we can only determine w: the cer=tainty ~~that they~~ contain Water, Air & perhaps an Inflammable principle. Some Chemists have tho^t y^t the O+ is the primogenial Acid, but this Opini=on cannot be supported since we are

ible to analize it in to diffirent parts.
Mr: Homberg on the other hand not only
denies that any of our Acids are truely
primitive, but also describes the Bodies w:h
he supposes combine w:th a primitive Acid
in the Formation of the four. he says 4:
there are three kinds of Sulphur. viz: -
Bituminous, Metallic & Vegitable. 4:
a primogenial Acid united w:th first of
these produces the Vitriolic - w:th the 2:d the
muriatic, with the 3:d and last the nitrous
and Vegitable. this Opinion of Hombergs
is not quite so chimerical as might at
first sight appear. for the Oil seems to
have the strongest Relation to Bituminous,

the ♂ to Metallic and the ♂ and ☿
to Vegitable Bodies. we shall not how-
-ever be able to prove a Primogenial
Acid Still we can transmit them into
each other.

There are other Acids different perhaps
from any we have mentioned. the Acid
which arises after the Dissipation of the Bil
& water of Animal Bodies - phosphorus
of Urine - the Acids of Arsenic - Amber
Borax and of several Bituminous Bodies
seem to be each a seperate & distinct
Species: but as their Chemical History is
not sufficiently established, we shall enter
upon it here, but proceed to y^e Division of
the Saline Bodies called Alkaline.

Of Alkalies in general.

There are three Species of Alkalies viz:
the Vegitable, the Fossile, & volatile.
a Definition of them may be seen
under the general head of the Objects of
Chemistry. These are again subdivided
in Caustic and mild. in the latter state
they produce a violent Effervescence with
Acids, wch has procured them y^e Appella-
tion of Effervescent. But in the latter
no Effervescence succeeds the Union, hence
Caustic Alkalies are called non-Effervesc-
ents — the mild Alkalis contain a great
Quantity of fixt Air. upon y^e Application

Of Alkalies

From fon of Acids the Air escapes rapidly
in an Elastic State, and produces the
violent Commotion in the Mixture
which has been called Effervescence.
Alkalies become Caustic When depri-
-ved of their Air. if these Acids are
applied to them in a perfectly
Caustic State, it is evident, no Effer-
-vescence will attend their Union be-
-cause the Alkali is deprived of any Air
which the Acid could restore to an Ela-
-tic State.

First Alkalies attract Air more stron-
-gly than the Volatile, Wherefore if a

Of Alkalies

add a portion of Caustic fixt Alkali to mild volatile, the fixt by receiving the Air becomes mild, and the volatile by loosing it becomes Caustic. This Experiment may be reversed. as may be seen in M^r Bridé's Experiments. &c

Caustic Alkalies dilaquate readily in the Air especially the volatile which can scarcely be obtained Caustic in a Crystalline State. Quick Lime is a saline Substance rendered mild by Calcination, and is upon that acc^t employed for rendering fixed Alkalies Caustic.

Of the Vegitable fixt Alkali.

This is an Artificial Substance formed by Art chiefly from the Incineration of Vegitables. It is as yet a matter of Doubt whether this Alkali formally exists in Vegitables, or whether it is generated in Incineration. It may easily be obtained from Nitre, but this Practice suits the Private Chemist only, being much too expensive for large works. Since therefore y^e Practice upon Vegitables is most universally interesting, I shall chiefly confine myself to the Description of it.

The Private Chemist ought to

Of the veg.e fixt Alkali

make use of German pot-ash, which is an Alkali calcined after being obtained in the Common method. but for large works we may chuse promiscuously any vegitables which the Climate affords, except the very inflammable & resinous woods. for these yield by Incineration an inconsiderable quantity of Alkali occasioned either by the liquor Quantity present, or a Dissipation from y.e Quick Inflamation of such vegitables. I am inclined to think it depends upon the last Circumstance.

During the Calcination of vegitables we must not admit too much Air, least

it dissipate the Ashes, nor entirely ex-
-clude it Otherwise the most intense
Fire will reduce the vegitable Matter
only to a Charcoal. The Ashes being
prepared we must lixiviate them in
Tubs w:th water, we extract three or four
Infusions from each tub, and y^e last if
very dilute may be returned upon the
next tub. the Ley is to be collected from
the Tubs, and the Alkali Obtained by
Evaporation. Care must be taken
in waporting this Ley always to keep
it of an equal Height in the vessel 'till
as much Salt is precipitated as the
vessel will conveniently hold. for if a

Of the veg: fixt Alkali

evaporate to Dryness, the Alkali comes so hard to the vessels, that in heating it so we shall hazard their safety. In several parts of England they obtain the Alkali from the Incineration of Straw w^ch has been infused in Ley. But as the Straw is then very difficulty inflamed we can not procure the Alkali free from part of the Phlogiston of the Straw.

Tartar which is produced by vinous and Acetous Fermentations affords fixt vegitable Alkali in greater proportion & purity than any Body whatsoever. it will also contrary to all vegitable matter suffer a Calination tho' excluded from

the external Air.

The Practise for Obtaining this Alkali from Nitre is fully described by Mac=quer. It is done by deflagration with Charcoal, all mettalic Filings except Gold and Silver, and with Tartar which Absorbs the Acid from the Nitre. if ye Nitre and Tartar are added in such proportions as that the Acid of Nitre may sufficiently carry off the Phlogiston of Tartar. the Resi=dua will be, from the Nitre a pure Veg: Alkali, and from the Tartar a white powder called White Flux. but if the Quantity of Tartar predominates greatly. we shall Obtain after Defla=gration, from the Nitre an Alkali as

Of the Veg:ble Fixt Alkali

before, but from the Tartar a dark colou=
=red mass called Black Flux. —

Fixt: Veg. Alkali is always more or
less Caustic, in proportion to ye Heat em=
=ployed in its Calcination; tho we cannot
render it perfectly so by Fire, because in
a certain Degree of Heat it fuses, and then
parts w: its Air very difficultly. in such a
Heat likewise it corrodes, and passes
thro' any Vessels we can employ, except
Gold and Silver, and even these will
not bear Heat eno to render the practice
convenient. Since therefore Calcination
will not answer our Intention, we must

Of the Veg: fixt Alkali

employ some Body y: will attract y^e^ air of the Alkali, without uniting w: it. for this purpose three parts of Quick-Lime added to one of Alkali is extremely convenient. This mixture is to be stirred in water, when the following Elective Attraction takes place. The Quick-lime will attract the mephitic air of the Alkali, and the Alkali uniting w: the water is perfectly suspended, while the Quick-lime is precipitated in the form of Calcarious Earth, having been rendered mild by the air of the Alkali. The Vessel must be at rest till the Earth subsides when the

Of the Veg: fixt Alkali

Liquor impregnated w: Alkali may be decanted. Alkali may be also rendered Caustic if mixed w: Alkali, and applied to the Fire. Another Method is to calcine the Alkalies w: their own Earth, or w: the Calces of M: except Gold, Silver & perhaps Arsenic for preventing Fusion. N.B. When the water impregnated w: Alkali is decanted we must seperate them by Evaporation to Dryness.

The Caustic Alkali however remains but a very short time in a dry Form, because it deliquesces & y: very rapidly. on this Acc: It is almost impossible

Of the fixt veg: Alkali

To preserve a Caustic Alkali in a dry or Crystallized form, for any length of time; but when it is mild it readily converts into firm prismatic Crystals. The best way of getting fixt Alkali perfectly mild is to expose it in broad shallow vessels to the Air, from whence it will attract a sufficient quantity of Air & moisture for its Crystallization, or it may be done by holding the Alkali over a Steam of fermenting liquor.

Properties of fixt veg: Alkali

It always has a peculiar acrid taste, more or less as it is Caustic or mild.

Of the fixt: & g: Alkali

Saliva contains an ammoniacal salt which is decomposed by fixt Alkali. hence the urinous taste which some Chemists have described. it is of a snow white Colour when perfectly pure. it emits no sensible Colour. it dilaquesces when caustic but concretes firmly when mild. in either state it unites w: all the Acids without any difference in the Neutral salts produced by each. it effervesces w: them in a mild state only. it has a stronger attraction to Acids than volatile Alkali.

It unites w: Oils forming Soaps. but when it is perfectly mild there are many

Of the Vegetable Alkali

with which it will not unite, and hence
the use of Quick-Lime among the
Soap-Boilers. it unites w: 2lb w: highly
concentrated Alcohol only when
Caustic: but if the Alcohol be very di:
-lute, the Alkali will unite w: 2lb & w: water
of the Alcohol, and remain separate.
hence the use of Alkali for concentra:
-ting Ardent Spirits. it unites intim:
-mately w: 7lb Sulphur forming a Soapy
Hepar Sulphuris. any of the Acids decom
-pose this, and produce a peculiar fetid
Odour.
It dissolves some of the Metallic Bodies

except Lead and Copper in their proper
Form: but unites wth most of them when
precipitated from Acids. it disposes M. S:
to Fusion and then unites wth all of them.
- its Effects are most considerable upon
Ores, because they usually contain a large
Quantity of Sulphur which wth y^{e} Alkali
producing Hepar becomes a very pow-
erful Flux to Metal: Substances.
It unites wth all Earthy Bodies, and
acts powerfully as a Flux, rendering some
fusable which alone are absolutely refracto-
ry. If applied Caustic to a Solution of
Calcarious Earth in Acid, the Earth will

be precipitated in a perfect State of Quicklime. Hence we may draw two Conclusions 1st That the Opinion of Some is groundless who suppose that remarkable virtues are imparted to Quicklime during Calcination, and 2dly That calcine, Earthy and perhaps Metallic Bodies are suspended in Air in a Caustic State or in other words deprived of their fixt Air.

The Affinity to Air and water is evident from its becoming mild when exposed to the Atmosphere. Caustic Alkali may be dissolved in equal portions of water, but when perfectly mild

Of the Vegetable Alkali

it is not soluble in less than 8 times its own weight.

Caustic Alkali in solution dissolves animal and vegetable substances of all kinds. - When it is not very caustic it acts chiefly upon the Glutinous and fatty parts of those ~~vegetables~~ Bodies in which their Colour usually consists, and hence the Foundation of its use in the Art of Bleaching. [For an Acc^t of its Symptoms &c see Black's Chemistry Vol: 2 -]

First Fossile Alkali

Is a native Substance very generaly dis-
=persed thro' the Earth, either in a
Separate or Compound State. it is 1st:
first of these it is found efflorescing from
the walls that are exposed to Cold and
Moisture — in a pure crystalized State
in the Earth, and according to Sthal
& Hofman in the Springs called Aci-
-dule. — In a compound State it is
found in an Earth near Smyrna ca-
=led Soap-Earth — in Borax — Glauber's
& common Salt. This Alkali seems to
be in the Ancients called Natrum or
Nitrum — from the great Analogy be-
=tween

Fixt fossil Alkali

The Description given of the former, and the well known Properties of y^e^ latter. I shall give only an Illustration of this Matter. Solomon says "to sing Songs w^th^ a heavy Heart, is like the mingling of Vinegar and Nitre" — If we suppose he meant the Neutral Salt which we call Nitre, the Allusion is no way striking. But if we suppose he alluded to y^e^ Conflict or Effervescence w^ch^ would attend the Mixture of Vinegar w^th^ an Alkali, y^e^ Figure is beautiful, and worthy the great Author who wrote it.

The Arabians who lived upon the Sea Coast obtained their fixed Salt from

first Prohibition Alkali

maritime productions entirely, especially
a Plant called Kali. This Practice was
long confined to Arabia & Asia, but
it is now common in many parts of
Europe especially upon the Coasts of
Spain bordering upon the Mediterra-
-nean, where the proper plants grow
very plentifully. After this Practice
was communicated by the Arabians
to the Europeans such of the latter as were
contiguous to the Sea Coast obtained
their Salts from any vegitables which
the Country afforded, and consequently
got the Name first Alkali. This they called
from the word Kali alkali but made

Fixt Fossile Alkali

no Distinction between the Fossile and Vegitable. Mr. Boyle observing some Differences in the common Alkali, and that imported from the Levant, star=ted some Conjectures wth Respect to two Species of fixt Alkali. Dr. Sthal recom=mended to his Pupils an Investigati=on of the Properties of each. this how=ever was neglected till Mr. Du Hamel published a Dissertation upon ye Fossile Alkali. this excited Chemists of Other Nations to make Inquiries, and it is now universally allowed to be a distinct Species of Fixt Alkaline Salt.

Methods of getting the Fossil Alkali

In Britain all Vegitables which are

First Fossile Alkali

found upon the Sea-Shore are employed for this purpose. They are dried incinerated, lixiviated &c, according to the Directions given for Obtaining Vegetable Alkali. the Alkali Obtained is a concrete Mass, containg a portion of Common Salt, Glauber's Salts & inflammable Matter. This answers very well the purposes of several Mechanicks as Glass makers - Soap Boilers &c. but if we require it in a very pure State for nice Operations, we must calcine the Alkali brought from y^e Mediterranean which is abundantly more free from

extraneous matters than y^e Common British Kelp. —

As this Alkali is the Basis of Common Salt, and Sal Glauberi, we may get it from either by proper management. if we use the former we must add Nitrous Acid, w:^ch decomposes the Acid of y^e common Salt, and unites w: its Alkali into a Cubic Nitre. this must be deflagrated with Charcoal when the Nitrous Acid will exhale, and the Alkali remain seperate.

Glaubers Salt deflagrated w:^th Charcoal forms a Hepar Sulphuris from which the Alkali may be attracted by any Acid. the Vegitable is best, because it

may be more readily dissipated than
any other. The Fossile Alkali more eas-
-ly crystalizes in a Caustic State than
the Vegetable, but since the latter
may tho' w. much difficulty, be ob-
-tained in a Crystalline Form, that
Property cannot be a universal mark
for distinguishing the two as Some
Authors have alledged. When these
Crystals are exposed to the Air, and
-cined powder appears upon their Sur
-face, w. ch soon afterwards deliquiates
It is less soluble in water than y.e Vegt
-ble, and will not unite w.th the vegt

Fixt Vegetable Alkali

Fusion. It unites with all the kinds like the vegetable, only producing different neutrals. Their Effects upon Inflammable, Metallic, Earthy, watery, Animal & vegetable Bodies are very exactly similar.

This Alkali has been called Nitrous Aegyptiacum to distinguish it from y^e^ mutual salts. The Spaniards call it Soda & Barilla from two plants of that name which afford it. The Italians use it in a concrete impure State, when they call it Rochetta, or in a purer powdery Form when they call it Pulverina. The grossconcrete Alkali prepared in Britain is called Kelp. we

Fixt Fossile Alkali

also import it much purer from the Town of Alicant, which is distinguis by the name of Alicant Kelp.

Of the Volatile Alkali.

This Substance is obtained by Artificial means only being never found in a native state. When two Stones are struck briskly against each other, a Smell arises which some Chemists have found similar to that of Volatile Alkali, and hence affirmed that it was a Fossile Substance. But if such an Odour can be observed after the Collision of two Stones, we should rather suppose that it was collected by the Stones which during Concussion might have entangled various Animal and

Volatile Alkali

Vegitable Substances which always contain a volatile Alkali, & this in a much greater proportion when they are subjected to Putrefaction. It is found y^t the Solid parts of Animals afford this Salt in the greatest Abundance; and Chemists have thot that Hearts-horn affor-ded a kind of peculiar Excellency, & them the genral Term Sp^t: Cornu Cervi. It is now however known that the Bones, Horns Hoofs &c of Animals under proper Manage-ment produce Volatile Spirits similar y^t of Hearts-horn, w^ch pass under y^e Original Name of Sp^t Cornu Cervi. The Caustic

Volatile Alkali

upon Animal and Vegetable Substances is performed by Distillation &c, and only proper for large works. Common Ammo-niac is a Subject from which this Sub-stance may be most readily Obtained by the private Chemist. the Process is to be carried on by Distillation w:th fixt Alkali, Calcarious Earth, or Metallic Substances. - I mention the latter rather to inform you of the Fact than to recommend y:e Practise w:th Metal: Sub:s - Calcarious Earth is best because it gives y:e Alkali in the most firm Condition. if 3 pounds of Calcarious Earth be added to lb:i of Sal Ammon: we shall Obtain in Distil-lation

Volatile Alkali

One pound of Alkali in a Volatile state
– this great proportion of Vol. Alk.
has long been a matter of Admirat-
-on to the French Chemists; but I
think the Phænomena may be
solved by considering that ½ Alkali
of the Ammoniac is in a caustic
state, that ½ Calcarious Earth de-
-composes it, and unites w.th the Acid,
& that ½ Alkali absorbs the Air
extricated from the Earth during its
Combination w.th Absorption not only
renders it mild, but encreases its weight
also. This Opinion is further con-
-firmed

Volatile Alkali

Experiment. If to 3ij of Sal Ammoniac be added 3iij of Quicklime, or fixt Caustic Alkali, we shall not obtain a third part of the Quantity obtained in the last Operation. —

Volatile Alkali may be artificially produced from a combination of all the Acids (except the Vegitable) w^th^ fixt Alkali. — Thus if we collect the Fumes of Nitre, fixt Ammoniacal Salt composed of Muriatic Acid, and Calcarious Earth, or Hepar Sulphuris wth^th^ diflagrated w^th^ Charcoal. they all afford a strong volatile Salt. Vitriolated Tartar digested w^th^ Alkohol produces a Vitriolic Ammoniac

from w:ch we can get the volatile Alkali

Volatile Alkali when mild readily ad-
-mits of a Chrystalization. it will cryst-
-lise when it is not perfectly mild, but
then it is more apt to dilaquesce. W
perfectly Caustic it can be Obtained in
a fluid Form Only. it emits pungent
Odour when mild, and in its perfect
Caustic State, it is One of y^e most pu-
-nant, and volatile Bodies we are ac-
-quainted with.

It is dissolved in Acids w:th the same
Phaenomena as fixt Alkalies. forming
peculiar neutral Salts distinguished
by the Epithet of Ammonaical. Di

Volatile Alkali

more weakly attracted by Acids than fixt Alkali, Magnesia, Calcarious Earths & Metallic Substances.

When mild it does not unite w: any Inflammable Matters; but in its Caustic State it unites w: all. This Union however does not seem complete, for it soon recovers Air from them & Effervesces. it unites w: Sulphur by Solution, and they both rise in Distillation.

Its Effects upon Metallic Bodies are not sufficiently ascertained, yet we know that it dissolves Copper, & several other Metals when precipitated from Acids. —

It does not unite w: any Earths.

Mr Dortand supposes that y Alkali of

Volatile Alkali

Ammoniac is blended w:th Earth, because if Sal of Ammoniac be distilled w:th Sal ordinary of Calcar: Earth, we shall Obtain Sal of Volat: Alkali, but we have already explained this upon much more Obvi=
=ous Principles.

Its Effects upon Animal & Vegitable Bodies are the same as those of fixt Al=
=kali, and it is reckoned a more pow=
=erful Antiscorbutic. —

It generates Cold w:th Water when very dilute or mild: but when Caustic and pure it generates Heat like other Alkalis.

When this is Obtained from Ani=
=mal Bodies, it is called Sp:^{t} C. Cervi — when from Ammoniac Sp.^{t} Am=
=moniac.

Volatile Alkali

Sal volat: Lp^r Ammoniac cum Calce viva. —

Some Chemists have imagined and not improbably that as there is only one primogenial Acid, so there is but one primogenial Alkali; different modifications of which appear to us as distinct species of Alkali. —

Of Neutral Salts.

Neutral Salts are produced by a mixture of an Acid and Alkali to the point of Saturation. These have been called by the Chemists Sales Salini because each of the Ingredients are Saline. Sales medii as y^e Company was in an intermediate State between the Acid and Alkali, but since their Properties are entirely changed. & a tertium Quid produced, I think the best Title that we can give them is Neutral. Chemists have expressed great Anxiety about determining the point of Saturation. Tho' in general

Neutral salts

We think we need not be very exact w: Respect to the proportions added, provided there is end of the Acid. Some Neutrals however require a very nice Adjustment of the point of Saturation! we may therefore add red or blue coulouring Veg: or Paper tinged w: the Juice of these; if the Acid prevails the Colour will become red, - if the Alkali the Colour become green, but if the Mixture is perfectly Neutral it discharges the Colour altogether. These Salts are often formed by employing mixed Bodies as shall be shewn more fully hereafter.

Neutral Salts

Neutral Salts when formed may be decomposed by various means, and many by the Force of Fire alone. But the Neutrals formed with Nitric Acid, and the Ammoniacal Salts are never sublimed altogether when Subjected to Heat. Some of them may be decomposed by Deflagration with Inflammable matters, & many by Elective Attraction in Consequence of the Addition of Aids.

The Nitric Acid having the strong Attraction to Alkalies, may decompose all the Neutrals formed by y Nitrous

Neutral Salts

Muriatic acid vegetable. the Nitrous decompose those formed by y^e Muriatic & Veg: ble — the Muriatic those formed by the vegetable Only. for the particular Neutrals formed by the Acids & Alkalies. see the Table at the Beginning of Your Chemical History.

The Ammoniacal salts may all be decomposed by fixt Alkalies & quick lime. — we shall now proceed to Each of the particular Neutrals, in the Order observed in the Table before mentioned.

Vitriolated Tartar

This Salt compound of Vitriolic Acid & fixed Vegitable Alkali is perhaps entirely an Artificial Production. Some have thought it was a native Substance, because it has been found in Ashes of Vegitables after Incineration but since it is never found in other Vegitables we may with more probability suppose that its formation depended upon an Acid imbibed from the Air, or to a peculiar Effect of the Fire. —

There are four Methods of forming this Salt — 1st By taking y^e Acid & Alkali both in a Separate State, 2nd By taking

Vitriolated Tartar

the Alkali Acid in a separate, and the Alkali in a mixt State. 3ly By taking the Alkali separate, and Acid mixt & 4th By taking two Compounds. This will be illustrated by the following Table in which all the Bodies are enumerated wch we can employ in the 4 Cases mentioned for Obtaining vitriolated Tartar.

Case 1st vitriolic Acid — — first beg: Alkali

Case 2nd
- vitriol: Acid — — Nitre
- ——— — — — Digestive Salt
- ——— — — — Regen: Tartar
- ——— — — — Mass of beg: Alkali
- ——— — — — Regar Lixivium

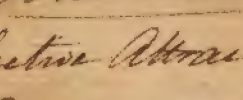
Case 3rd
- Vegitab: Alkali — Vitriol: Ammoniac
- ——— ——— — Vitriol
- ——— ——— — Tartar w[th] Vit: Acid
- ——— ——— — Sulphur.

Vitriolated Tartar

Case 4th { Vitriolic Ammon — { Neutrals of veg. alkali
Vitriols
Earths, w: ~~veg. alk.~~ — — —
Sulphur — — — — Nitre

In the 4th Case the Practice is very inconvenient; for when y^e Vitriol. Ammoniac is applied to Neutrals containing veg. Alkali, as for Instance Nitre, the Acid of the Ammoniac unites w^th the Alkali of the Nitre into a vitriolated Tartar, and y^e Acid of the Nitre forms w^th the Alkali of Ammoniac a Nitrous Ammoniac w^ch must be separated by sufficient Degree of Heat. if green Vitriol be applied to Nitre y^e following

Vitriolated Tartar

double Elective Attraction will take
place. - grow of that  and therefore
necessary to
seperate ~~by a double combination~~, the
Vitriolated Tartar from the new
combination of Nitrous Acid & Iron
will be found extremely inconvenient.
In the same manner we might draw
Schemes for the Combinations w: h:
form all the Neutrals: but we shall
leave them to yourselves by way of
Exercise, and proceed to consider w: is
the best method of obtaining Vitriolated
Tartar.

The Combination of the Acid &

Vitriolated Tartar

Alkali as in Case 1st may deem y^e last
last y^e point of Saturation so diffi-
-cultly hit, that it is almost impos-
-sible to obtain it pure this way. Or
-most sensible of this Inconvenience
practise upon some of y^e Sulphurs in
Case the 3.d which will yield no more
of their acid than is just sufficient
saturate the Alkali, we shall ob-
-tain a Vitriolated Tartar by this means
extremely pure. Sulphur de fegato
w.th Nitre gives a volatile Vitriolic Acid
which unites w.th the Alkali of the

Vitriolated Tartar

Nitre (its Acid being dissipated with ℔ ss
Inflammable principle of the Sulphur) ℥ iv
forms a Salt called Polychrestum. This
is much more Soluble than Vitriolated
Tartar, and ought perhaps to supersede it in all Prescriptions. immediately
after the Deflagration we must secure
the Salt in every close Vessels. for any
means we can practice for purifying this Salt will also render it upon
Vitriolated Tartar by restoring its Acid
to a fixt State. —

Chemists have given various
Appellations to this Salt as obtained

Vitriolated Tartar

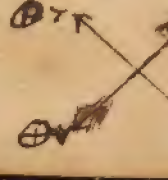
from different Subjects. When Obtained from Nitre and Vitriolic Acid, it is called Nitrum Vitriolatum. When Obtained from the Matter in Case it has been called Sal Prunum Parabolicum. Sal Duobus. Arcanum Duplicatum. Panacea Duplicata Helvetii

When prepared w: Antimony it is called Nitrum Stibiatum. When prepared from Sulphur & Nitre it is called Sal Polychrestum. This is Nothing more than a Vitriolated Tartar when Acid is in a Volatile State.

Vitriolated Tartar

The Properties of this Salt are as follows. It is of a remarkable firm Concretion, — of difficult Solution in Water — assumes the form of hexagonal Crystals; it is the most difficultly fused of any Salt whatever with a small Degree of Heat it decrepitates. it may be decomposed by Nitrates. it converts it into Hepar Sulphuris. When Vitriol. Tartar is applied to a Solution of Siberian Nitrous Acid, a Decomposition will take place in Consequence of an Elective Attraction described in the following Diagram:

Vitriol Tartar in the Salt of this Acid. —



This is a true Solution of Dr. Ethal's problem for decomposing =

Of Glauber's Salt.

This is a native Substance composed of Vitriolic Acid & Fossile Alkali. it may be also produced Artificially by the various Combinations mentioned in y^e Table of Vitriolated Tartar, which Table will serve likewise for Glauber Salt if we substitute the word "Fossile Alkali" in the Room of Vegitable. but the most convenient Method is by Distillation w^th Common Salt and Vitriolic Acid. in this Process y^e Vitriolic Acid decomposes the Acid of Common Salt, which must be dissipated by Heat when the Vitriolic will be left

Glauber's salt

combined w.th the Fossile Alkali. y.e Neutral thus formed differs considerably from Vitriolated Tartar. The latter crystalizes very firmly - is difficultly soluble in water & extremely fixt in the Fire. y.e former is of a very loose texture, easily soluble in water, and very fusible in Fire. In Vitriolated Tartar receives a small proportion of water into its Crystals, Glauber salt the greatest of any Neutral Whatsoever. This salt calcined & added to water forms a Coagulum provided free access of the external Air be admitted. - It may be decompound by y.e same methods as Vitriolated Tartar. —

Common Nitre

This Substance was quite unknown to the Ancient Greeks and Romans. — The Arabians first manufactured this Salt, and by them it was introduced into Europe. It is now chiefly imported from Asia. Tho' whether it is an Artificial or Natural Production we are not certainly informed. Probably the former because it is never found native in Europe. The most Authentic Account we have received concerning y^e Production of Nitre in Asia is, That in a dry Season they use fire to y^e Operation or

Common Nitre

Surf of their Land. When Rains fall the Alkali produced is washed to a small Depth in the Earth, where it meets with a Nitrous Acid. The Earth thus impregnated yields its Nitre by Lixiviation & Evaporation.

To obtain Nitre most conveniently in Europe, we ought to chuse a Clay Soil as a Matrix. This Ought to be impregnated with Animal, and Veg: Bodies as strongly as possible. The Putrefaction of these is greatly expedited by the Addition of Lime. This Matter will also resolve the viscid tenacious Texture of the Clay which might otherwise inve-

-lope

part of the Salt. common Salt adds to that putrescent matter is in some measure converted into Nitre, and never fails to be generated more or less during the Putrefaction. This Matria must be exposed to the Air by as large a Surface as possible, and defended entirely from the Rain: so essentially necessary is the Air not only to Putrefaction, but to the Generation of particular saline matter, that we not find the Matria impregnated enough for use at more than an Inch from its Surface. — The Salts generated by these putrescent

matter will be volatile Alkali, and Nitrous Acid, forming Nitrous Ammoniac. If then we lixiviate it w.th strong fixt Alkaline Ley, it is evident y.t by Evaporation we may obtain a Common Nitre, in Consequence of y.e Decomposition of y.e Ammoniac. in this Procss a portion of Common Salt will be produced, which by a proper Crystalization may be seperated from the Nitre.

Spring, & Autumn are prop.r Seasons for the preparation of Nitre, because Putrefaction is retarded by y.e violent Cold in Winter, and the Saline Matter when generated an exalted by the intense heat

Common Nitre

of Summer. hence we see y^e^ Reason why in hot Countries Nitre is produced best when its Matria is exposed to Northern winds, and at y^e^ same time we see the Fallacy of an Opinion w^ch^ some have entertained y^t^ Nitre floats in the atmosphere from Northern to Southern Regions. ——

Cubic Nitre.

This Substance composed of Fossile Alka-
li, and Nitrous Acid is very rarely found
prepared by Nature, and then very near
the Surface of the Earth only. This con-
firms the Opinion that Nitrous Acid
never exists independant of putrid Ani-
mal or Vegitable Matters. a great
quantity of this Acid is certainly washed
into the Bowels of the Earth; yet we
never find it under any Appearance,
but at a very small Distance from the
Surface of the Earth. this leads us to sus-
pect that by the Oconomy of y^e Earth
Nitrous, after passing a considerable

Cubic Nitre

Depths, is converted into the Vitriolic Acid
Cubic Nitre may be Obtained by adding
the Nitrous Acid to the Fossile Alkali, or
by distilling the former w: the common
Salt. this Neutral concretes into Rhom-
=boidal Crystals: but in Other Properties
it may exactly resemble Common Nitre

Of Common Salt

Common or Alimentary Salt is a na-
-tive Substance, collected in vast Masses
in the Bowels of the Earth as in the Mines
of Lithuania & Cracow in Poland, or
diffused thro' the waters of the Ocean,
or the waters of Springs. When it is got
from Mines it is called Rock-Salt or
Sal Gem, but as the Production of Salt
from impregnated waters more imme-
-diately belongs to the Business of the
Chemist, I shall confine myself chiefly
to a Detail of that Practice, only ob-
-serve here w.th Respect to the Sal Gem &c.
frequently metallic and earthy Matters

adhere to it. we discover the first of these
by the blue or green colour which they
impart, and the latter by its adhesion in
substance to the surface of the salts in
either case it may be purified by filtra-
tion.

Common salt is prepared from im-
pregnated waters by evaporation with
heat of the sun or culinary fires. this is
very much expedited by admitting air
to as large a surface as possible of the
liquor before, and during the evaporation.
To effect the last of these purposes we
may employ large broad vessels for the

Common Salt

first some have contrived long narrow
Houses. in them About 20 Feet asunder
are built two Floors in y^e^ form of Cisterns
for holding the water. The upper Cistern
or Floor is perforated w^th^ Numerous small
Holes, thro' w^ch^ the water falls into y^e^ Cysterns
below, thro' a swift Current of Air intro-
duced by a Door in each side of y^e^ House.
— The Contrivance has been improved by
suspending Brush wood between y^e^ Floors
by which means the Surface of y^e^ water
is very much enlarged & Consequently
Evaporation as much exhalted. w^th^ a
Convenience of this sort we may reduce

Common Salt

the Water to a Saturated Brine, wch
may be crystalized wth a small Expence
of Fuel. a Method this wch is practised
in Germany.

In Britain there are several Manu-
-factures for Salt of Sea water. This is
done in large Boilers wth an inconsiderable
-ble Evaporation either from any Ignorance
or Avarice of the Proprietors is generally
pushed too far, whence two Inconveni-
-ences arise 1st the Salt by too great
Heat is in some Degree decomposed
by wch its Antiseptic power is diminish
-ished, & 2ly a portion of Marine Glauber

Common Salt

Salt always present in the waters of the Ocean concrete w: 4 lb common salt, Whereas by a more moderate Evaporation the former would have remained entirely suspended, while the latter would have concreted in a pure State. Sea water, and Salt Springs generally contain a large proportion of heterogeneous matter. This may be separated before Evaporation by Clarification w: Whites of Eggs, or Animal Fluids of any kind as Blood &c, which entirely entangle all floating matter, and coagulate on the surface. The Salt obtained by Evaporation

Common Salt

is called Bay-Salt from the great Quantity produced in the Isle of May wh: is of the greatest purity of any except the Sal Gem of some mines. it is procu=red in the following manner. large Basons or Reservoirs are formed contigu=ous to a Bay in that Island, & only sepe=rated from it by a Mole of Sand. thro' this the water filters or is driven over it in Storms. the water thus collected is en=tirely exhaled by the intense Heat of the Sun in Summer, & ye Salt left very perfect on the Bottom of ye Reservoir. the Bay Salt of Europe is considerably

Common Salt

less pure than that of may, tho obtaind by the same means. The Dutch purchase this, purify it, and afterwards sell it at a low price. — it is said they add a peculiar Acid obtained from Milk, to which the purity of the Salt is attributed. but I have not been able to procure this Acid.

The Residuum of common Salt after boiling is called Bittern, or y^e^ bitter purging Salt. this is compos'd of vit: Acid, and Magnesia. —

Common Salt forms Cubical Crystals, and when fair pure has a fair white Colour — an agreable taste — requires 3 times its weight for Solution

Common Salt

— Never deliquesces in the Air — does not easily calcine — not so readily fusible as Nitre, ~~and does~~ nor so refractory as vitriolated Tartar, and a very powerful Antiseptic. as its purity decreases all these Properties will be proportionably lessened. the Quantity of this Salt dissolved in a hot or cold menstruum is nearly the same. —

Dr. Pringle says that a large portion of this Salt acts as an Antizeumic: a small proportion expedites Putrefaction. the Dr. however is certainly mistaken, and his Error probably arose from the Impurity of the Salt which he used. —

Digestive Salt

This is intirely an Artificial Substance, compound of Muriatic Acid, & fixt vegetable Alkali. The Process for Obtaining it is fully described in the Londondispensatory. it assumes larger & firmer Crystals than common Salt, but in other Respects they are nearly y^e^ same.

Regenerated Tartar

This Salt composed of Veg: Acid, & fix'd Veg: Alk: is prepared by art only & may be procured in a very elegant form by the Directions given in y^e last Edition of the Lond: Dispen:^y — It never assumes the Form of perfect Crystals, but appears dry and flakey, hence it has been called Terra foliated Tartar, & from a particular Medicinal Property Sal Diureticum. it deliquesces in y^e least Exposure to the Air, dissolves in an equal Weight of Water, & is readily fusable. it may be decomposed by all the Acids. it unites w:^th Essential Oils — Resins — & some

Regenerated Tartar

of the Gummy Substance. it unites the w: Alkohol (ch w: has been employed as a Part of its purity) forming a menstruum for several metallic Substances, on w: neither Substance seperately applied produces any change. thus if a Solution of Gold be evaporated or precipitated the Calx becomes Soluble in a Mixture of Regenerated ♃ and Alkohol.

Sal Polychrestum of Rochelle.

This is an Artificial Substance com-
-posed of Veg: Acid, and Fossile Alk:
- It was accidentally discovered by one
Segnette an Apothecary of Rochelle in
France, who having used Sp: Sal Alkali
for obtaining Regenerated Tartar, found
by: a Salt was produced of a firmer Tex-
-ture, and of less Solubility than Rege-
-nerated Tartar. He published it accor-
-dingly w: the Appellation of Sal Poly:
-chrestum Rochelle or Segnette. This
Salt ch: superside Regen: Tartar in all
Prescriptions. —

Soluble Tartar

This is an Artificial Substance composed of the Acid of Tartar, and fixt Vegitable Alkali. I find contrary to ye Opinion of Some that this Salt will assume a Crystalline Form if exposed to a Moist Air for a Sufficient length of time. Regen: and Soluble Tartar, are the only fixt Alk: Neutrals y: can be dissolved in Alchohol. the Combinati-on of the latter w:th Alchohol, is not so powerful a Menstruum for Oily Matters as some have supposed. we shall pro-ceed to mention the Neutrals w:ch ye Acids form with Vol: Alk: disting:d by ye Name of Ammon-

Common Ammoniac

This Salt compos'd of Muriatic Acid, & Vol: Alk: was unknown to the Ancients Greeks & Romans. w: Thrycadi Ammoniacal Salt was nothing more Sal Gem. There have been many Disputes whether this is an Artificial or Native Substance. I think it ought to be ranked among the former since it is never found but in Consequence of Inflammation E.g. - It is found in the Fumes of Volcanoes - of Brick Kilns, or burning Coal pits, where Soot or Smoke is fire. Quere, whether there are Opera-

tions

of Nature or Art? — It is imported to us chiefly from Asia where it is prepared from the Soot of burnt Cow Dung: that it is never absent from the Soot of any Inflammable Fuel. — It may also be made by a mixture of the separate Ingredients. It concretes into 4 pointed Stars or Crystals. it readily dilaquesces in the Air, but becomes more firm after Sublimation. it sublimes in a very gentle Heat without Decomposition. It is Soluble in Alcohol & Water, generating Cold w.h & latter by encreasing its Quantum for other Salts. in Sublimation it renders several Inflammable & Metallic Bodies very volatile. it may be decompounded by Vit.ol Nit. Acid or by fixed Alk.s —

Vitriolic Ammoniac

This is an Artificial Substance com-
-posed of Vitriolic Acid, & Vol: alk: Vitri-
-olated Tartar may be converted to this
Substance by Deflagration w: 2lb Inflam:
-mable Bodies. It is less soluble in water
than Common Ammoniac, & not at all
soluble in Alchohol. it also concretes
more firmly, and does not dilaquesce in
the Air. it Sublimes without Decom-
-position tho D: Hoffman is of a contrary
Opinion. Glauber assigns more Properties
to this Salt than it really possess. -

Nitrous Ammoniac

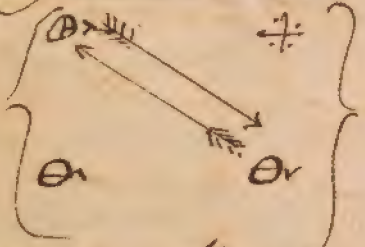
Is an Artificial Salt: composed of Nitrous Acid, and Vol: Alk: - It may like the Other Ammoniacs be decomposed by Inflammation, or by Elective Attraction of Other Bodies. it assumes a Low concrete Texture & is readily Soluble in Alchohol or water. It is the Only Saline Body we know that is inflammable without imediate Contact of burning Bodies. The great Inflammability of this Salt seems to depend upon the Quantity of Inflammable matter contained in the ~~Acid~~ Vol: Alk: because the Disposition of Nitrous Ammoniac to inflame decreases as we employ a purer Alk:

Vegitable Ammoniac

This Salt formed by any veg. Acid & Volatile Alk: is called also Spiritus Mindereri. it is always very imperfect as we get it from the shops & this arises upon the great attention that is required for producing an accurate Saturation. If the Acid and Alk: be combined till all Signs of Effervescence cease, and the Mixture be kept for some time, upon the Addition of more Alk: & Effervesence may be renewed. this may be repeated several times. Chemists have been very anxious to get this Salt in a solid Form. the Method generally practised is

Vegitable Amoniacal

by Sublimation: but y^e volatility of y^e water, and Salt are so nearly equal, y^t it is attended w^th the utmost Difficulty to prevent both from rising. a very con-venient Method has been for some time practised by the addition of Regenerated Tartar, & this the Amoniacal when an Elective Attraction takes place as expressed in y^e following Scheme. -



In Distillation the Reg: Acid & Volatile rise, and form in the Receiver a Crystalline

Vegitable Ammoniac

Concretions Soluble in Water or Alcohol like Regend: Tartar it increases ye dissolvent power of the latter, & deliquesces readily in the Air. — This was employed by the late Dr. Ward for curing indurated Swellings of the Testes. —

N:B: We must always take equal Quantities of the ~~Acid~~ vegitab: Acid & Vol: Alk: to produce the Veg: Ammoniac. —

Of Borax

This Substance is imported from Asia in a very impure State, & is afterwards refined by the People in Europe. tho' of the Original Production & management of Borax we are entirely ignorant.

Some have supposed it an Alkali because it changes the Syr: of Violets green — disposes Earths to vitrify — precipitates Metals dissolved, & very powerfully promotes their Fusion. but from unquestionable Experiments it is found to be a Neutral Salt composed of Fossile Alkali, & a peculiar Acid no where to be met with but in Borax. Chimists have

Of Boras

called this Acid Sedative Salt, and from Mr. Homberg its first Discoverer The Sedative Salt of Homberg. This Acid forms tender foliated Concretions wch are soluble in a very small proportion only, even in boiling water. but by the Application of Heat it becomes soluble in Alcohol. When exposed alone to a strong heat it suffers no Dissipation but wth the Addition of water it may be exhaled. it forms Neutrals wth all ℔ Alkalies, wch may be again decomposed by all the Acids. but the Properties of Salt thus

Borax

except Borax are very little known & less frequently employed. Sedative salt is obtained from Borax by Distillation w: the vitriolic acid most conveniently. the first Distillation affords a small Quantity, so that it must be 10. or 12 times cohobated before we can get all 4: 4 ℔ Borax will produce. —

Of Inflammable Bodies

The next Class of Bodies to be consider-
-ed is the Inflammable: But before I
describe these particularly, I shall make
a few general Remarks by wch we may
always distinguish Inflamation from
Ignition. Inflammable Bodies are distin-
-guished by a quick Succession of their
parts when exposed to burning Fuel: -
-by the luminous Vapour or Flame wch
they receive on their Surface, or by the
Exhalation of all these Appearances in
vacuo. Ignition is said to be when
Bodies in Contact wth burning Fuel re-
-ceive a great Degree of Heat without

Of Inflammable Bodies

any imediate or sensible consumption of their parts, and when these Effects are readily produced in bacies.

There are certain Bodies in Nature which appear to be luminous without producing or propagating Heat, & which suffer no consumption of parts. These are called Phosphori.

Tho we find such innumerable Bodies in Nature y: are capable of Inflammation yet their Inflammability seems to depend upon the presence of one of these Forms viz. Oils. Sulphur & Alchohol. I not pretend to affirm that these are y: Only

Of Inflammable Bodies

Species of Inflammables, but that they are most obvious & universal. Chemists in general do not suppose that these several forms each profess a distinct Inflammable principle; but that they are only different Modifications of one primitive Phlogiston. —

We shall now proceed to consider them Matters in Order, & first the Oily. These are divided into Expressed, Empyreumatic & Essential.

Expressed Oils

These are formed by nature & deposited in Animal & Vegitable Bodies, the most obviously, and frequently in y^e^ former. — They are free from any peculiar Odour or Taste, which distinguish them sufficiently from the ~~gums~~ Essential. — many disputes have arisen whether these Oils are produced by y^e^ Œconomy of ~~Vegetables~~ Animal Bodies, or whether they are taken in here w^th^ Vegitable Aliment, and only secreted by proper Organs. — In stead of a living Animal the Expressed Oils

Expressed Oils

are mostly fluid; but in the ordinary Temperature of the Air they either concrete or become ~~flu~~ viscid.

Animal Oils are contained in a tender cellular membrane. Therefore to obtain them we must first destroy this cellular Texture, then liquify and express them. In the Liquefaction of expressed Oils the Heat applied must be extremely moderate, and gradual; Otherwise they soon become empyreumatic & incapable of firm Concretion. These Oils when exposed long to the Air change their White for

a brown greenish or black Colour - ac-
-quire a disagreeable Odour & rancid Taste,
and are then said to be Rancescent.
Rancescency seems to be the Effect of Fer-
-mentation, and this Fermentation seems
to depend more upon ye mucilaginous
Matter always more or less present in Oils,
than upon the Oils themselves. for Butter
wh of all Animal Oils is the most disposed
to Rancescency, may be kept sweet for
a longer or shorter time, according to the
proportion of the mucilaginous or other
parts of the milk remaining. Thus
Reaumeur found yt by frequent Liquefac-
-tions

Expressed Oils

Ablutions he procured Matter of a very pure & lasting kind. — Expressed Oils of Animals unite with Acids and Alkalies producing Soaps with the latter. they unite also with same Neutrals, — producing Neutral Soaps. they unite with other Oils, tho' whether by proper Mixture or Solution we do not know. —

They unite with Sulphur forming Balsam of Sulphur. — they dissolve several Metals. the Calx of Lead united with Expressed Oils forms Common Plaister. they refuse all Union with Earths and water, excluding the Calcarious which is properly a saline Body.

They do not afford an Alkali in Calcination like other parts of Animals.

Expressed Oils

In Distillation they give over first watery impregnated w: Acid, and then Oils w: ch vary somewhat in the different stages of the Distillation. The Oils thus obtained have been called

Empyreumatic

From a peculiar fœtid Odour w: ch they retain. They are also of a dark Colour, Acid to the Taste, and soluble in hot Spirits. by repeated Distillations their Fetor & Acrimony are diminished, and their Solubility in Ardent Spirits encreased. They may by this means be rendered quite colourless and void of fœtid Odour. in this

Expressed Oils

Most Authors have ascribed many Virtues to them. but the Labour of procuring them perfect, and the pains necessary to exclude entirely the external Air, which w^ch quickly bring on Rancescency render them scarce exhibited Medicine. if we are careful in conducting the Operation w^ch a very gentle Heat, and in separating the Faces of each Distillation, three or four Rectifications will be sufficient, tho Dr. Hoffman advises ten or twelve. Quick lime must be added to absorb the watery Oils. —

Expressed Veg: Oils

These are prepared & reposited by nature chiefly in the Fruits & Seeds of Vegitables. like the Animal they are enclosed in cellular Substance, & are to be extricated by the same means. But as they are generally fluid, we may omit Liquefaction. because they are very much disposed to Rancescency & this Disposition is greatly encreased by Heat. When obtained from the most acrid vegitables they are perfectly inodorous. Their Chemical properties & Relation to other Bodies is precisely the same as the Animal. they also afford by Distillation —

Empyreumatic Oils

Which undergo precisely the same Changes as the Animal. The London College directs y: we should distill Oyls which have been cimmerized red hot in the y: Empyr: Oils. The Oyls serve the same Purpose as Calcarious Earth or Quicklime.

Of Essential Oils.

Essential Oils are obtained chiefly from vegitable, tho' Castor & Musk which are Animal Substances contain an Essential Oil. they generally retain the Odour, and Medical Virtues of the Subjects from which they are obtained, which distinguishes them from the Inspissated & Expressed. from the latter they may also be known by their Solubility in Ardent Spirits. -

They may be obtained either by Distillation w: water, or in some vegitables by Expression alone. -

all vegitables contain more or less of Essential Oils, and this also predominates

Of Essential Oils

in particular parts of vegitables, as the Root, Bark, Body, Leaves, Flowers, Fruit Seeds, and at certain periods of vegitation each of these parts contain the greatest proportion of Oils: Nature intends to bestow thereon. for When Plants begin to vegitate, the Sap precipitated in winter to y^e Roots rises gradatim to the Trunk, Branches & Leaves &c. — Therefore whatever part of any vegitable we employ for Obtaining Essential Oils, let it collected at the point of full maturity. The Nature of the Subject when chosen must be

Essential Oils

entirely & minutely broken down by Triture, or otherwise according to the size of the parts. and in Distillation on the following Analasis of Vegitables generally takes place.

1st: a Phlegm rises.

2nd: an Acid —

3d: the Remainder rises in form of a pure Oil which burns darker & darker in proportion to the Duration of the Procep. a Char remains in the Retort which in Calcination yeilds Earth & fixt Alkali. in this procep large Refrigeratories must be employed and the Subject macerated before Distillation

Essential Oils

fill the water hath penetrated this it.
If we suffer the subject matter to
lie at the Bottom of our Vessels they will
burn as it is called, therefore we must
use Agitation till it boils. The motion
then excited will be sufficient to sus-
pend the matter.

Water is added as a Medium for Re-
gulating the Heat. But it is soon covered
with Oil which excludes Air from its Sur-
face, and by that means renders it
so fine as to bear a Degree of Heat in w:
some Oils will be rendered Empyreumatic.
The Oils when Obtained must be kept in
close Vessels, for in the Air they suffer

a Dissipation, and thereby loose their Fluidity and Odour.

Dr. Boerhaave supposed y^t: all the active power of Vegitables depended upon a subtile matter in their Essential Oils which he called Spiritus Rector: because ℥i of Cinnamon in Distillation, after yielding ʒij of Oil becomes a Caput mortuum. This Oil may also be rendered inert by dissipating a few Grains of its weight. This Hypothesis however Specious it appears seems to be groundless, since all y^e properties of the Subject may be restored by a second

Essential Oils

Distillation w: pure water alone.

Essential Oils unite w: Acids generating Heat, and w: the Nitrous they frequently break out in actual Flame. Mr Geoffroy found that a Combination of Vitriolic and Nitrous Acids would inflame all the Essential & Inflammable Oils, and most of the Resins. Mr Ruelle has since produced the same Effects with the Nitrous Alone, under a particular management. They unite w: Alkalies forming Soaps. They unite w: all the Inflammables. - w: Sulphur forming Balm of Sulphur. - w: Alcohol generating Cold. -

Of Essential Oils

They dissolve Lead and its Calx, & act weakly on Iron, and Copper. they refuse all union with Earths. Their Union wth water is very perfect as we may observe in the distilled waters of mint Aniseed &c wch are nothing but Common water impregnated wth Essential Oils.

Of Camphire.

This is a Substance of a very peculiar nature; but several circumstances determine us to refer it to the Head of Essential Oils. Like them it is found in the cellular Substance of a particular Vegitable, and may be extracted by the same means. it forms fair white Concretions. Some Essential Oils forming like Concretions have been called by the Chemists Camphires. but the Difference between them is very remarkable, these Oils generate very violent Effervescence Heat, & sometimes Inflammation

Of Camphire

with Acids. Whereas Camphire generates Heat & Effervescence & never inflames the Acids. Essential Oils suffer Decomposition in the Fire: Camphire sublimes without Decomposition. Essential Oils are destroyed irrecoverably by Acids: Camphire dissolved in Acids may be precipitated by addition of water. if Nitrous Acid be added in a dilute State to Camphire it dissolves it only as an Oil swims on its Surface. —

Balsams & Resins

Essential Oils exposed for some time to the air assume the name & appearance of Balsams or Resins. They contain more oil than Oils to which perhaps their thick Consistence is owing. Their solubility in Alcohol renders them very useful for the various purposes of varnishing.

Fossile Oil

There is properly but One Species of this called Naphtha. When it is pure it is limpid and thin, laying aside both the Propriety: this in proportion to its Impurity: it is generally found flowing from the Bowels of the Surface of Springs. Asphaltum, Bituminous Judaicum, Pit-Coal &c all afford Naphtha in Distillation: Therefore Naphtha & Sulphur must be the Bases of Oil & Inflammability of all fossile Substances. To strengthen this Hypothesis, let us observe that from

Fossile Oil

the Tops of many Mountains, as those of Modena in Italy a Naphtha continually flows. this gradually in its Descent turns thicker, and more heterogeneous; forming in its passage Petroleum, Asphaltum Bitumen Judaicum, and at last Common Pitcoal. —

Amber & Ambergrease

Tho they appear different from Fossile Oil: yet in Distillation they give a perfect Naphtha & Vitriolic Acid. Ambergrease is distinguished by a very fragrant Odour. — Amber resists the Force of Alkalin Menstruums

Amber

But in Distillation yeilds 1st water 2d water and Acid 3d dry Salt. 4th a Fetide Oil. the Residuum dissolved in rectified Oil becomes a fine Varnish. —

Of Soaps.

The Term Soap has been applied to all Combinations of Oil w. Saline matters. The Combination of neutrals Oils is only temporary, a Seperation very soon succeeding their Union. Water is only proper for Combinations of Alkali Oils. Soaps may be composed of all 4 different Oils; yet the Expressed are most commonly used. Some have preferred the use of Fetide

Of Soaps

Alkali for making Soaps because ye Soaps brôt from the Mediterranean (where ye Fossile Alkali is employed) are better than those of Other Countries. this however seems to depend upon the fresh veg: Oils wch the People of the Countries near ye Mediterrn: are able to procure. for we find by Experiment that Fossile and veg: Alkalies of equal purity produce with the same Oils Soaps exactly similar. the Alkali employed must be in a Caustic State, & ye: London College direct us to dilute it wth: water till a Pint of the Ley weighs only 16℥. – this will do for most Oils, but a much stronger

Of Soaps

Ley will be required for the Solution of the Oils of Fish, wch. are generally used for our Soft Soaps. The Ley & Oil being combined. we must subject the mass to gentle Heat wth: considerable agitation till a clear gelatinous Substance is pro:duced. this Mass may be formed in to con:crete Cakes, by the Addition of a neu:tral Salt to seperate its water. a portion of the Salt always unites wth: the Soap wch: renders it an improper medicine in some Cases as in the Nephritic, and hence its purging Quality. Soap may however be freed from Common Salt by dissolving it

in Alcohol, when the Salt will be precipitated. The Alcohol may be recovered by Distillation, and the Soap remain very pure. — This I must observe is a very tedious practise. The Heat employed in the Ordinary process for making Soap is not hurtful. Mr. Geoffroy among many others was of the contrary opinion. He therefore proposes that we should make Soap by Agitation, and a perfect caustic Alkali, without the application of Heat. but we object to this proposal that the time required for a perfect union of the Oil & Alk. would render the former rancescent, and

Of Soaps

Consequently render it useless for the purpo-
-ses of Medicine.

Soap is liable to Decomposition when expo-
-sed to the Air. Therefore when it is to be
used as a Medicine all sh^d: be previously
taken off & w^ch: has been corroded by the Air.
for this Reason also a great number of
Soaps sh^d: never be made at a time.

- Does this Decomposition depend upon
the Absorbtion of an Acid or Mephitic
Air? — Soaps may also be decomposed
by Acids separate or combined w^th: other
matters. the Oil Obtained by y^e Decompo-
-sition is ~~sufficiently perfect for w^ch~~
~~refer you to [illegible]~~ soluble

in Ardent Spirits. Maquer's Theory concerning this Subject is sufficiently probable, for which I refer you to his work. The first is also partly converted into a volatile Alk: so by the Addition of Vitriolic Acid to Soap I get a portion of Vitriolic Ammoniac, w: the vitriolated Tartar. as this is very generally a peculiar kind of Acid present in the Stomach, Soap taken when taken as a Medicine commonly in Consequence of a Decomposition. —

Of Sulphur

The Second Species of Inflammables is Sulphur a concrete friable mass, not Soluble in Acids, water or Alcohol. all Mr: S: are found in Combination with Sulphur except Gold, Zinc, and perhaps Platina. Arsenic affords it most plentifully, and it is the Opinion of some Naturalists that these two either Separate or in Conjunction mineralize all the Mr: S found in a State of Ore. When a small proportion of Sulphur is combined with Arsenic, the Compound is called Orpiment. when a very large Proportion it is called Sandaracha. Sulphur is frequently found native in

Of Sulphur

the Earth. but the most common way of obtaining it is from Pyrites by Eliqua-tion. it is afterwards purified by Sublima-tion, & collected in a powdery form called Flowers of Sulphur. —

Sulphur may be artificially produced by Deflagration of Charcoal w.th any neutral salt containing vitriolic Acid, for in Con-sequence of Deflagration a Hepar Sulphuris will be produced from which pure Sulphur may be precipitated by any of the Acids.

Vitriolic Acid and Lead forms a metallic salt from which Sulphur may be obtained by ~~Distillation~~ Sublimation. it may also be produced by Distillation w.th

Of Sulphur

Nitrous Acid & Oils, or entire vegitables which contain Oils. This last Fact explodes the Opinion of some who have held that Opium was the only vegitable matter from which Sulphur could be extracted by this means, and that from most of its Virtues were derived. It may also be obtained by adding ☉ to Alcohol. Thus we see that Sulphur may be formed by adding its Acid to either of the other Species of Inflammables. Is not this favourable to the Opinion of one simple & universal Phlogiston?

Sulphur may be decomposed by Fire.

Of Sulphur

The Acid of the Sulphur is also in some measure decomposed by exposing to the Air. And if united w: Filings of Iron breaks out into actual Flame. it sublimes entire without leaving any Residuum.

Sulphur is not dissolved evenly the most concentrated Vitriolic Acid. it is soluble in Alkalies forming w: the first Hepar sulphuris w: substance is much of y^e nature of Soap. It is Soluble in water & Alcohol. its Solubility in the latter gives rise to the Tinctures of Sulphur, and we include under this Head w: are called Tinctures of Antimony & other Metallic Substances. for it is certain that the Metallic part of these are no way

affected by Alcohol. - Hepar Sulphuris is a very powerful menstruum for Mt: even acts upon Gold so far as to render it soluble in water. The Matter precipitated from Hepar Sulphuris by the Addition of an Acid is called Lac Sulphuris. The Fumes of Hepar Sulphuris turn ℥ss of white Metals of a black Colour. Letters wrote w: a Solution of Lead or Silver why dry do not stain the Paper; but if a Paper dipped in the Fumes of Hepar Sulphuris immediately become legible.

Sulphur distilled w: Sal Ammoniac and Quicklime gives a Liquor strongly impregnated w: Sulphur & a vol: Alkali w:ch

Of Sulphur

called Tinct. volat. Sulph. Hoffmanni.
Quick silver added to this Tincture forms
Cinnabar. —

Sulphur unites ℞ w: all Oils into Balsams
entirely changing their Properties. it does
not in a perfect State unite w: Alcohol. ℞

It has a great affinity to Metals:
so y: Chemists in all Ages have supposed y: a
pure Elementary Sulphur entered into the
Composition of all Metal: Substances.

In a Separate State it has no Effect
upon Earthy Bodies, but in the form of
Hepar Sulphuris proves a powerful flux
to them. —

Of Alchohol

Alchohol, Spirit of wine or Ardent Spirits is produced by art from a particular Fermentation of vegitable fluids only. The term Fermentation was formerly applied to the Production of Alchohol alone, But as later Chemists have enlarged its signification it will not be improper to speak of Fermentation in general, and then describe each particular Species.

Of Fermentation.

If in any mass of matter an Intestine motion arises, it is propagated thro' the whole till it becomes homogenous

and if a portion of this matter being added to a Quantity of Fresh, the latter is assimilated, and becomes also homogeneous. Such Matters are said to be in a State of Fermentation, and y^e^ matter added is called a Ferment. y^e^ Maturation of the Fruit. Sudr. &c of Vegitables, and the Rancescency of Oils seems to be owing to peculiar Fermentations. The Diseases of Animals and Vegitables sometimes dep^d^. upon Fermentation excited by a Ferment. Thus in Inoculation for the Small Pox, the little portion of Variolous matter added assimilates the whole Fluids of a sound Animal Body, & thereby induces y^e^ Disease

Of Fermentation

Again if an Ear of wheat affected w: the Smutt be applied to Grain in y^e most vigorous State, the latter will soon receive the Infection, & communicate it to the next contiguous, & so y^t in this way the Fermentation may be propagated ad Infinitum. —

Fermentation is divided into the Vinous w^ch produces Ardent Spirits, the Acetous w^ch produces an Acid — and the Putrefactive by which a vol: Alk: may be obtained. The first of these is w: belongs to our present purpose, and we shall therefore confine Ourselves chiefly to y^t

Vinous Fermentation

This takes place only in vegitable Juices, and more or less in these according to the quantity of Saccharine matter which they contain. When all this matter is extracted from any veg: substance it becomes incapable of Fermentation. From this it appears that the Vinous Fermentation cannot take place without the presence of Saccharine Juice. — The Ancients thot: all vegitables were capable of this Fermentation, but we find that the very sweet bitter or aromatic plants are not only themselves incapable of Vin: Fermentation but will prove to be powerful Antiseptics

Of Vinous Fermentation

Dr. Boerhaave ~~[illegible]~~ distinguishes the plants incapable of Fermentation into Alcalescent & Avescent.

Among the Vegetables w: are proper Subjects of Fermentation, some contain in their Juice a Sugar prepared by nature which runs spontaneously into Fermentation. Others require Artificial means to resolve their Saccharine matter, such as the Farinaceous Seeds of Plants. Liquors produced from the former kind are called Wines; those obtained from y^e latter are called Ales or Malt Liquors.

The Juice of the Vine is a Subject y^e

Of vinous Fermentation.

most commonly, and w: the greatest ~~profit~~ advantage employed for the making wines of any whatsoever. The Saccharine Juice when first expressed is called must. This must be diluted w: two three times its own weight of water, and exposed for some time to the air in shallow vessels which must be kept as much at Rest as possible. The matter in this State is turbid, more viscid than water, sweet to the Taste having no peculiar Odour. After it has remained some days air Bubbles begin to appear w: it being very elastic, but each other quasi nervosum. This causes an Intestine motion attended w: some Heat & Intumescence. These Bubbles arising at

the Surface are there entangled, by the
Viscidity of the Liquor, & at length form a
Crust. from this a Vapour is exhaled
which affects Animals with Giddiness &
Palsy, - extinguishes Flame, and renders
Caustic Alkali mild. during the process
Earthy Matter is precipitated to the Bottom
— we must then divide the Crust with the
Hand, and if the seperated portions do not
remain perfectly at rest, but discover the
least tendency to unite, we may conclude
that the Fermentation is not sufficiently
perfect. After these Appearances the Liquor
becomes transparent, & void of Viscidity, ac-
-quires a benignant taste & grateful Odour,

Vinous Fermentation

affords the Title of Wine from which Alcohol may be produced by simple Distillation. we must secure it in Bottles, where in Order to its becoming wholsome Drink it must undergo Another slow & long Fermentation. the following Circumstances must be observed for excluding y^e^ Fermentation, first the proper Fluidity of y^e^ Liquor 2:^nly^ the proper Application of Heat 3:^rd^ the Communication w:^th^ y^e^ Atmosphere & y^e^ undisturbed State of the Vessels. —

As to the I:^st^ Sugar is a Salt w:^ch^ in its dry concrete Form is soluble in water & Alcohol, very inflammable, and not only incapable of Fermentation,

but is really one of the most powerful
Antifermentives we have. When it is
diluted w:th 1/3 of Water the mixture is
called a Syrup, which also resists Fermen
-tation. On the contrary if the Liquor
be too dilute, the Air Bubbles arising
in Fermentation will not be sufficiently
inviscated, and on that account will ex:
-plode and discharge a matter y^e Reabsorption
of which seems absolutely necessary for y^e
production of Wine. The most general
practice is to procure the Liquor of such
Viscidity as exactly to bear a new laid Egg
- perhaps a still greater Dilution will

Vinous Fermentation

to be improper: Observing at the same time
but much greater Visidity is required in
hot than in cold Climates. The best
proportion for home made wines is 5 parts
of water, and 2 of Sugar & Fruit as Currants &c.

II. The lowest Heat at which vinous
Fermentation takes place is 42°: and
if the Heat be encreased to 80°: an Evapo-
ration of the Liquor will be produced. Dr.
Boerhaave imagined that the best Degree
of Heat is between 60° & 70°. But the fi-
nest wines seem to be produced in Tempe-
ratures between 50°: and 60°. The intense
Heat of the torrid Zone is the Reason why
no good wines are produced in Countries,

exposed to its Influence.

III.ly We may by Digestion produce some small Degree of Fermentation in vacuo. but free Access of the Atmosphere is requisite for rendering the Vinous complete. —

IV.ly The last of the Impel contributes much to the Formation of Wine, for by Agitation the necessary Formation of Crust on the Surface will be prevented, & the precipitated Lees be raised up which never fails to renew the Fermentation.

All Attempts to establish a Theory of Fermentation have as yet been

Vinous Fermentation

It is generally thot to depend upon a Resolution and a certain Reunion of the parts of Saccharine matter. These Phænom.a may also depend upon the Introduction of some new matter into the subject, or upon y.e Dissipation of some heterogeneous matter from it during the Fermentation. We can determine w.h some accuracy y.e Resolution of the Saccharine matter takes place. That the matter first liberated is an Acid appears from the Taste which the subject matter acquires, and from y.e power w.h all Bodies that Absorb Acids exert in checking Fermentation. Another

matter separated is an Elastic Mephitis as appears from its Effects in killing Animals - extinguishing Flame, & in reducing Caustic Alkalies to a mild State. we know very little about y^e other parts of the Operation.

That the production of Alcohol depends upon a Reunion & Reabsorption of the parts separated, appears very probable from its total absence when y^e Mephitic Air exhales from too great Liquidity or Agitation of the Liquor, or when y^e Acid is by any means involved as soon as it is extricated. we are hence led to conclude y^t the chief properties of Alcohol depend upon

an Acid and Mephitic Air. we may Observe also that y^e Inflammability of all Bodies seems principally to the Effect of an Acid and Mephitic Air, Whence it is not improbable to suppose that y^e 3 forms of Inflammables depend upon a simple Phlogiston formed of these two Matters combined in different proportions, or y: in Alcohol there is the greatest proportion of Mephitic Air, that in Oils y^e Acid predominates & y: in Sulphur it predominates still more. —

As both the first & second Vinous Fermentations are apt to proceed too far, we

must prevent it by the addition of some
matter which resist Fermentation.

Of these none is more powerful than
Sulphur, so that Must may be preserved
many months in Casks impregnated with Sulphur
without any appearance of Fermentation.
& for this purpose it is employed by the
Wine makers. it is hard to say how the
Sulphur acts. we know that during Inflam-
-mation it affords an Acid and a matter
in all probability is Mephitic Air. Whether
-ter whatever it be seems to act most
powerfully as an Antiseptic since it
requires a very large proportion of Acid to pro-
-duce

Effects which may be produced from a given quantity of Sulphur. Fermentation is frequently checked by the Approach of Thunder-Storms. as this happens sometimes without any considerable Explosion it is not improbable to suppose that it is the Effect of Electrical matter which the Air at that time is greatly impregnated. if this Theory should be found true it will be unfavourable to the Opinion of an Acid residing in Electrical matter.

Acids. Alkaline Salts - Absorbent Earths - Neutral Salts - Metals - Alcohol - Animal Mucilages, the most noted of which:

Ins. Whites of Eggs - Bile - Resinous Bodies
- Bitter and Aromatic plants - Chips
of Woods &c are all Antiseptics and
most of them are used as such. Alkalies
seem to act by preventing the Evolution
of fixt Air, or Absorbing the Acid as it
is extricated. Absorbent Earths probably
act in the same manner tho' they differ
as being promoters of the putrefactive
Fermentation. Animal Matters act
perhaps only by entangling the fer-
menting particles w^h: Alkalies would renew
the Fermentation. The Italians cover
the Surface of their Wines w^h Oil, chiefly

Vinous Fermentation

for excluding the air we employ Corks.
- The Vinous Chiefs & Shavings seem
to act partly by their oily properties, and
partly by absorbing the first air & ~~bubbles~~ Acid
when evolved.

The three forms of Fermentation are:
each attain a very regular and
sudden progression. if therefore we desire
to reduce a Subject to any particular
form: & by the putrefactive, we might quick-
-ly preside the work by adding some body
as Absorbent Earth to prevent y^e^ Vinous
& Acetous. —

We have observed y^t^ Wines are not fit
for drinking till they have undergone a

a second Fermentation. This sometimes is very suddenly and entirely stopped. — The Liquor then becomes vapid and ropy, inclining to putrefaction. The Causes of this Disease may be 1st: Immaturity of the Fruit employed; 2nd: The Presence of some Antizeumic substance. — too languid Fermentation at first, by which the whole of the Must is not properly assimilated, or on the contrary 3rd: by too active a Fermentation which dissipates the parts evolved & prevents the Reunion. or 4th: too great a Degree of Cold, which may precipitate parts keeping Solution during the usual Fermentation

of the Air. We must remedy this Disease by exciting a new Fermentation which may be effected by the addition of a such as fresh Ferment — by Stirring up the Lees or if these have become inactive by adding the fresh Lees of other wine. or it may be sometimes produced by the Application of Heat.

In the Second Disorder to which Wines are liable they become thin & sour. The Cause of this may be a second Fermentation too Actively renewed. — the Approaching Warmth of Summer — transportation on Ship Board — a Continuance in Cellars near the Streets of populous Cities, or any

Vinous Fermentation

After many Months they are subjected to frequent Agitation. — upon this Acct. the Spaniards & Portuguese add Alcohol to their Wines before Transportation. —

Qualities of different Wines.

The newer the Wine is, the greater appears of Flowering which proceed into a Yeast and vice versa. Wines are strong or weak in proportion to the Quantity of Alcohol — sweet or sharp in proportion to the Quantity of Saccharine matter they contain.

Italian Wines are made sweet generally by checking the first Fermentation.

Qualities of different wines.

. this however disposes them to ferment in the Stomach.

The luscious taste of Tokay wines depends upon the sweetness and perfect maturity of the Grapes from wch they are produced.

Rhenish wines are obtained from acid Grapes — hence their sharp taste. — Wine is made rough by mixing the Husks of Grapes, or by steeping them when unripe.

Those which are called virgin wines are obtained by a gentle expression of very ripe Grapes. Wines of a correspondent but inferior Quality may be produced by a second or third Expression. —

Botanists agree: that there is only one species of the Grapes; and yet they different

Changes under w^ch^: they appear are ow=
=ing to the Soil, Culture, Climate - Expo=
=sure &c. these Changes however are so
permanent & considerable that a pro=
=per Choice of them for producing diff^t^
Wines is extremely necessary. —

The Proprietors of Vineyards never
use the Fruit of a Vine which is more
than 15 Years Old, from y^e^ Age to 100 it
is tho't to be in a State of Improvement.
the full Maturity of the Fruit is tho't
such a necessary Circumstance for y^e^ produ=
=tion of delicious Wines, that y^e^ people of
Burgundy are restrained by the Law from
plucking their Grapes till a Magistrate
has proclaimed them fully ripe. —

Of the Qualities of Wines

A chalky or gravelly soil on y^e^ Southern side of a hill is extremely favourable to the growth, and perfection of the vine. —

Of Malt Liquors.

These are produced from the Cerealia, or farinaceous Buds more particularly Barley. they differ from wines in being produced from vegitables that require an Artificial process for evolving their Saccharine matter. —

Of Malting

As the Conversion of Grain into Malt, or in other words the Evolution of its Saccharine matter, is only the progress of Germination; let us first consider in w^h^ manner Nature

carries on this work. —

Seeds when carefully examined are found to contain two distinct parts, one which produces the Root, and y^e^ other the plume of the Plant. When y^e^ Seed is properly supplied w^th^ moisture & y^e^ radical & plumous parts begin to germinate, each tending to opposite extremities of the seed. in consequence of this Germination a Quantity of saccharine matter is evolved. this encreases till the parts arrive each at its respective end; but after they have run over this the Mash the production of the saccharine matter is exhausted. these circumstances must be carefully observed in conducting the Operation. — The Barley

Of Malting

must be macerated in water for a Sufficient time. we must then expose it in thin Layers to dry. it must be often turned Over to prevent Putrefaction, and to expose every part equally to the Air. When the Grains are sufficiently malted, they must be dried in Kilns made for y^e purpose. the Fuel employed sh^d smoke as little as possible. Quick drying leaves the malt tender and nutritious, yet Care must be taken not to give it an Empyreuma. Slow drying in the Air renders the malt tough, and almost reduces it to its Original Farinaceous State. When the Grain becomes very sweet, and y^e Plume

is just ready to issue from the Lobe of the Leaf, we may reckon the Malting perfect. –

The Grain thus husbanded is to be broke down in Mills contrived for y^t purpose, & then y^e Saccharine Matters to be extracted by Infusion in water. This is called Mash-ing. This wou'd be greatly exhanced by the Application of boiling water, but that Heat suddenly applied will coagulate the Malt, so y^t we Sh: be careful to apply the Heat gently. Thus it must stand till a considerably strong Tincture is extracted called Wort. if this is kept too long it will run into an Acetous Fermentation wch England is called Turning in Scotland Blinking.

Of Malting

The same Malt may be infused several times to extract all its Saccharine matter, and to prevent the Fermentation y^e w^d: take place if another infusion of water continued too long.

These several Extractions are to be inspissated by boiling for giving a stronger Liquor. - perhaps boiling serves no other purpose, since the wort obtained by many infusions of cold water affords a Liquor equal in every Respect but strength, to y^e: of the concentrated wort. I must observe however than in the wort boiling we often see fibrous Filaments floating, if these are the farinaceous parts of the Grain remaining in the wort, & which are

coagulated by the Heat as some imagin.
the Boiling certainly contributes much
to its Inspissation. When the Liquor is
sufficiently boild, it must be cooled hast
-ily in large shallow Vessels. After this
it must be subjected to a vinous Fermen
-tation, which is to be promoted by Yest,
or some other Ferment. —

Ales are extremely disposed to acetous
Fermentation, that it is always usefull
to add some Anticeptic Substance. Of
the Vegitables Hops are most generally
employed for the purpose, not only be-
-cause they powerfully resist Fermenta-
-tion, but likewise on ye Acc: of ye agreable

bitter taste w^ch they impart to y^e Liquor. y^e
less Heat employed in extracting y^e Bitter of
the Hops the more agreable is the Taste of
it, for in the common method of boiling
the Aromatic Bitter of the Vegitable is
changed for one y^t is disagreably styptic
to the Stomach; the Flavour of
fruit Hops therefore would be more Accurate-
ly preserved by simple Infusion. but as
this practice would be attended w^th a great
Expence of Hops, it will probably always
be neglected by Frugality.

Ales are subject to all the Diseases inci-
dent to Wines, and these are to be remedied
by the same means.

Distillation of Alcohol from bindi

Alcohol being more volatile than the other parts of wine & ale, may be obtained from them by simple Distillation for this purpose the Liquor must be employed at its most perfect state of Fermentation. in the Conduct of the Distillation great Care is necessary to prevent Inflammation, viz: the Liquor very readily contracts either from a peculiar Oil which it contains or from the Contact of the Lees, or other subsiding matter viz: the Bottom of the Copper. These Inconveniences are to be obviated 1st: by Agitating the Liquor till it boils for the Suspension of the Lees 2nd: by bringing on the Boiling as soon as possible, and

Distillation of Alcohol

from by procuring a very equal Degree of Heat. Besides the Empyreuma which may arise from too much Heat applied, the Vapour may be driven thro' the Refrigerating Tube without being consumed. This by the working is called a blowing of the Still. We cannot here avail ourselves of the common boiling point of water for regulating the Heat, because the Still acting in some measure as a Digestor, increases the Fixity of the water.

In the first part of the Distillation there comes over — pure Alcohol very much diluted w^th^ water — and if the mouth is

carried on too long, an Acid & Empyreuma-
-tic Oil arise. - Notwithstanding all possible
precaution the Alcohol obtained by a
first Distillation will be impregnated with
an Empyreumatic Oil. This may be
-quated by repeated Distillations with water,
but the two chemen finding many Distilla-
-tions considerably expensive, make use
of Acids or Alkalies for concealing the
Empyreuma. Acids are to be preferred
because they give the Spirit a very agree-
-able taste. —

The Quantity of Alkohol yielded is some-
-what in proportion to the Quantity of
Saccharine Matter contained, and by

Distillation of Alchohol

activity of the first Fermentation, which is generally most perfect when we employ the largest Quantity of Malt. —

The Purity of Alchohol may be discovered by its Burning to Dryness. we may procure it to be still more pure when it does not act sensibly upon Caustic alkalies. But the most accurate Test by far is the Specific Gravity which we must examine After every Distillation, and when it come out the same for three or two Successively, we may be certain it is in the purest State possible. —

The Alchohol whether Obtained

Distillation of Alchohol

from wine Ale &c is exactly y^e^ same Liquor. the diffirent Odours & Tastes entirely depending upon y^e^ Essential Oils of the several Subjects.

The Addition of water in making Punch decomposes in some measure the Oils of the Spirit, so that we may judge not of their Odour in that state. Spirits are improved by keeping in wooden Casks because the wood Absorbs their Oil.

Properties of Alchohol

It is the lightest & most volatile fluid known except Ether, and vol: Caustick.

Properties of Alchohol

It is probably the most inflammable Liquor tho' it takes fire at a greater Distance, on Acc^t of the Vol: Fumes it sends off; yet perhaps its Inflammation does not so soon commence upon the sudden Application of Heat. it inflames entire without having any Residuum. it will suffer very numerous Distillations without any Change, but w^th the Addition of fixt Caustic Alkali it gives us an Acid which unites w^th the Alk: into a Salt very much resembling Regenerated Tartar.

Alchohol when applied to the

Properties of Alchohol

Vitriolic Acid effervesces generating Heat, and under proper Management produces an Ether vitriolic; [illegible] more of this hereafter.

With the Nitrous it exhibits more violent Effervescence & Heat than w: the vitriolic Acid, producing likewise a Nitrous Ether.

Alchohol admits of some Union w: the Muriatic Acid, tho less than w: either of the former. its Union w: the Vegitable Acid is still more imperfect.

Alchohol in its Ordinary Degree of purity does not unite w: mild

Properties of Alchohol

Alkalies, but w.ch the Caustic forms a matter which has been much celebrated by the Chemists, tho its medical virtues are not properly determined. The famous Sp.t vol. Aromat. is composed of Alchohol, vol. Alk. & Essential Oil. We have various processes described by Authors for Obtaining this Spirit, but they are mostly improper. Simple Digestion is probably the best method that can be employed. The French Eau de Luce is nothing but this Spirit Obtained by Digestion. it dissolves some of the dilaquescent Salts. —

It does not unite w.ch & Expressed

Properties of Alchohol

Oils, except when they are united are
=covered from fixt Alkali. it unites w:
the Other Oils in proportion to their quan
=ty. Sulphur is not soluble in Alchohol
except in the Form of Alkar.

Alchohol unites w: none of 4 M.S.
Earths or Earthy Salts. it unites w:
Water generating Heat, & diminishing
the Absolute Bulk of the Ingredients
before Mixture, but after a certain
Quantity of Water is added the Heat ceas
=ses to be generated, & the Bulk to be
diminished. it coagulates Animal fluids,
and resists every kind of Fermentation.

Properties of Alchohol

I must here observe that wine converted by Fermentation into vinegar does not afford any Alchohol in Distillation alone, but w: the addition of M: S: as in the case of the Sachar: Saturn: &c we may readily obtain a large proportion. Do the M: S: here evolve an Alchohol w: was before latent in the vinegar? or do they contribute to a new production of Alchohol by restoring y^e^ requisite w: has been dissipated in y^e^ vinous Fermentation? — Down y^e^ former opinion is most probable, since we find that very highly concentrated vinegar

Properties of Alchohol

is capable of Inflammation.

Of Ether

This was known to the Ancient Chemists but never came into great Reputation till About Thirty years ago. When Frobenius Invented an Ether to the Royal Society w.th the Intent for Examining it, giving Directions at y.e same time, That it sh.d not be Opened till after his Death.

Before that time however two French Chemists discovered the Method of Making it. We have since had various Methods described; but the most simple

Of Ether

easy and the best method is the follow-
ing. —

The Vitriolic Acid & Alcohol must
be taken as pure as possible, in the
proportion of 2 parts of the latter, to one
of the former. We must then put the
Alcohol into a Retort, and add the
Acid very gradually, stopping up the
Orifice after each addition, & Observing
not to add a second portion 'till the
Heat produced by the first has entirely
subsided, for otherwise we shall ha-
-zard a violent Effervescence & Explosion.
— When the Acid is put in first it often

remains at the Bottom w^th^out Effer-
-vescence; in this Case we must use
Agitation.

When the Mixture is thus made
a Receiver must be luted on as close
as possible. it must then be raised by
Heat quickly to a very gentle Ebullition,
and after y^e^ an equal Degree of Fire must
be preserved. in the Course of this
Distillation various Matters come
over. 1^st^ Alchohol alone. 2^nd^ a dulcified
Spirit 3^dly^ Æther. 4^thly^ volatile vitriolic
Acid, & lastly a more oily Æther called
Oleum dulce. the Matter left in the
Retort now becomes black & thick.

Of Ether.

If the work is continued longer Bubbles will begin to appear, as soon as these are seen the Distillation must be stopped, or such an Intumescence will immediately ensue, as will force the matter into the Receiver. To separate the Ether from these several matters, we must first pour on a quantity of water. The Ether & w: a portion of Acid adhering will rise to the Surface immediately. it must then be poured off by a proper Seperating Cup, and to it we must add a weak solution of Alkali and water ch w: will perfectly seperate the Acid, and leave the pure Ether on the Surface of the water.

Of Ether

If by this means the Ether should not be sufficiently pure, we may rectify just the whole to a second Distillation, when the Ether will rise first with a small quantity of Alkali adhering. We must then stop the work, and add to the matter a portion of clear water which will instantly eliminate the Alkohol. More Ether may be obtained by adding fresh Alkohol to the matter in the Retort.

Properties of Ether.

a Slip of paper dipped in Ether will take Fire at some Distance from the Flame of a Candle. This

Properties of Ether

a great proof of its volatility & inflammability; yet it does not possess y^e latter property so perfectly as Alchohol. It volatilizes under the Receiver of an Air pump, leaving an Acid Residuum. When extremely pure, a drop will exhale in falling a few Feet thro the Air. It has been absurdly supposed that Ether will burn under water, because when water is pourd upon flaming Ether, it is immediately buoyed to the Surface without the Extinction of its Flame.

It unites w: Acids effervescing and emitting copious Fumes. it bears a Relation to Caustic Alkali like Ether Caustic

Matters. It is by no means such a powerful menstruum for oily matters as some have supposed. it extracts the Fats imperfectly, but much less powerfully than the Smell and Colour of Aromatics by containing Essential Oil. it does not unite with Earths or Metals. —

If to a Solution of Gold in Aqua Regia Diluted w. water, a Quantity of Ether be added, the Gold will be immediately seperated and suspended by y Ether in its pure Metallic State. This happens with Essential Oils & Alcohol. I shall not to mention Another Phenomenon

Properties of Æther

with Respect to Gold, that when fused together w^th various Æthereal Metals, it always rises to the Surface. — on what principles do these Phænomena depend? — for a fuller Acc^t of Æther see Beaumé Elements. —

Alcohol moderately impregnated w^th Vitriolic Acid gives the — —

Spiritus Dulcis.

This was formerly obtained by Digestion, but in this way the union is not perfect. we are therefore directedly the Lond: Coll: to practise Distillation w^th equal parts of the Ingredients & by the Edin^r Coll: w^th only $\frac{1}{8}$ of the Acid.

Of Spiritus Dulcis

In the latter the Quantity of Acid diminished is not sufficient, in y^e former it superabounds. so that we must retain it w^th y^e Addition of an Alkalie.

The Ol: Dulc: w^ch arises in y^e Distillation of Æther, forms w^th Alchohol wt is called by Hoffman, Liquor Anodynus Mineralis.

Alchohol unites w^th y^e Nitrous Acid, & exhibiting the same Phænomena as Æther, only in a greater Degree forming an Æther which differs somewhat from y^e foregoing in Odour and Colour. This is to be obtained by Digestion only, for the

Properties of Alcohol

Violent Effervescence renders a Distillation impracticable. — at any rate it is extremely dangerous to use a concentrated Acid. We must therefore dilute it w.th an equal Quantity of Water. This must be added to an equal Quantity of Alcohol in the following Manner. First put the Acid into a Phialon or Matrass. Then cautiously pour on the Alcohol w.th will float upon the Surface of the Acid. close the Aperture of the Vessel as accurately as possible. The Mixture must be performed slowly and the Vessel closed w.th the utmost Exactness.

Properties of Alkohol.

Winter is the most proper time for this Practise. But at w: ever season it is carried on we must keep it in ye coolest place, and as perfectly at Rest as we are able. The Liquor at different times must be very gently moved, and this is to be done till no Bubbles appear upon shaking the mixture. The Æther will be collected on the Surface. —

Alkohol admits of a Combination wh: muriatic Acid, tho' not sufficiently eno' to form an Æther. —
Its union wth: veg: Acid is still less perfect.

Having now finished ye three

general forms of Inflammables,
we might reasonably enquire whether
there are any more in Nature? I would
rather say there are such Mean determina-
tions. They are. The Inflammable Matter of
Charcoal seems to be of a peculiar kind.
M: C: also seem to have a peculiar In-
flammable Quality, since all of them
except Gold and Silver will burn away
in a sufficient Heat. This may be attrib-
uted to the Acid w^ch they contain, but Lime
into whose Composition no Acid enters
is very inflammable. ——

Metallic Substances.

There is no part of Chemical knowledge more deficient than y: of Metals. all the Traditions we have had from ancient times are fallacious & imaginat. More among them who were Adepts in the Art, kept their Discoveries Mysterious views entirely secret. — in later Days few have studied the Doctrine of Metals sufficiently, especially the Chemico-historical part. I shall not here attempt to give you a complete view of the Doctrine of Metals. but only their Relation to Pharmacy & Physic, & a few fundamental Facts y: may

Metallic Substances

assist You in prosecuting the Study. I refer You for a Definition of M. S. to the first part of our Course upon the Subject. M: S: are divided into metals & semimetals. The distinguishing Characteristics malleability, peculiar only to the former. The Names of them are

Gold
Silver
Lead,
Tin
Copper
Iron
Quicksilver.

The last of them has been acknowledged a metal ever since the Russian Experiments have proved it malleable. The

Of Metallic Substances

Semimetals are

Zinc,
Antimony,
Bismuth,
Cobalt,
Nickel.

These are all native substances found constantly in the Bowels of the Earth. but before we explain their particular situation, it will be necessary to premise a few theoretical Remarks concerning the Structure of the Earth. —

Theory of the Earth.

In digging into the Earth we find various Strata which compose it. These Strata seem to be concentric, running

Theory of the Earth

Strictly parallel to, or inclined at a very small angle w: the Earths Surface. Their Breadth is frequently extended in a uniform manner, over a vast Tract of Country. — Their Depth is very inconsiderable w: Respect to their Extent; since we generally find our 100 strata in descending 200 Fathom below y: common Surface. The Matter of the Strata is generally Earthy or Stony, & sometimes inflamable. From the Appearance of these Matters they appear evidently to have been suspended in a fluid Form. & from the Shells, and other Marine Productions found in the Bowels of the Earth

extremely remote from the Sea it is probable that this Fluid was y^e Ocean. Philosophers have adopted various Systems to account for these Appearances. Some think y^t the Earth emerged at y^e Creation in its present Form. Others think y^t the present form was assumed in Consequence of the Mosaical Flood. all seem to agree however that the Earth was Once entirely or partially dissolved in the Ocean, and y^t the Solid parts subsiding from y^e Fluid formed the various Strata. during this Subsidence it is probable that considerable Cracks or Fissures frequently happened. the

Theory of the Earth

Appearance of subterraneous Caverns
seem to favour such a notion; for we mostly
find that the Depressions of one side an-
swer to the Eminences of the other.
Mr: Laymare a Swedish Gentleman thinks
that he can perceive w:h he calles Origi-
nal Mountains differing in Structure
from the Strata w:h surround them. He supp:o-
ses that these Mountains exisited before
the Deluge, and that they were never entire-
ly covered w:h Water. That when the Flood
retired the solid parts subsided in different
Strata in the Vallies between them. He
says y:t in burrowing a Stratum we often
find it terminating &c: the Original Sides

as he supposes of a Mountain. That the Mountains are composed chiefly of Crystalline matter confusedly blended without any regular Strata, and y^t that they never contain any marine Production. None of these Theories however can be universally true, since there are accidental Causes w^ch must ever since the Deluge have occasioned considerable Changes in the Structure of many parts of the Earth. Such are the violent Eruptions of Subterranean fire, or water bursting from Caverns, or the continual Falling of Rain which in

a great length of time may produce considerable Effects. to these we may add Earthquakes, and the continual Action of the Sea. tho it may be said that these violent Causes do not often act, Yet it may be demonstrated, that they have happened very universally in different Ages.

The waters exhaled from & precipitated again upon the Earth are replete with various matters, many of w: are deposited during their Filtration thro the Earth. these matters combining w: particular parts of different Strata produce the various Minerals & Metals &c: in nature. we generally find them in Vertical Fissures

mentioned before, w^ch by the Metallurgists
are called Veins. I do not affirm y^t
Metals are always found in y^e Vertical
Fissures, and no where besides, for they
are sometimes disposed between the
Strata, and most frequently in y^e Origi-
=nal Mountains. The Veins of Metals
constantly are lined w^th an Earthy Crust
called by the Miners Spars or Spar.
— There is between this Crust, and y^e Metal
a thin Layer of Clay. The Metalliferous
=ter is not always continued uniformly
=ly thro the Vein, but is often interrup-
=ted by various Substances interspersed,
according to the Strata thro w^ch it penetrates.

Of Metals

This strengthens the Opinion of a certain Combining w:ch assists the formation of dif-
-ferent fossile, and M: Substances.

Metals are found in the Earth under four Appearances.

1:st in a Native or virgin State.

2:nd Corroded or dissolved by Acids in the form of powder, & sometimes Crystals.

3:dly in the form of Calces or Precipitates. I make this Distinction because I am uncertain Whether they assume y:r form by a precipitation from Acids, or by Actual Calcination.

The 4:th State in w:ch they are found is that of Ore. This happens in Consequence

Of Metals

of mineralization by Sulphur or Arsenic both, or either combined w^th^ an Earthy or stony matrix. Chemists & Philosophers particularly Dr. Haller have endeavoured to prove that M^s^. & were generated from Sulphur and Arsenic, but hitherto in vain. When Metals are found in a virgin State w^ch^ more rarely happens than any other, they are generally in y^e^ form of Plants, hence the Term Vegitation.

Of Gold

This Metal is very universally found in its pure State adhering to an Earthy Crystalline matrix called Quartz. it is perhaps never Absent from Sand, tho

Of Gold

seldom in such Abundance as to repay the Labour of extracting it. we are however led to think that Metals under some Circumstances have a power of mineralising Gold, since Mr. Cronstadt an Accurate Author says that it is united often with Silver, and also in some way: from is a Mine in Hungary where Gold is extremely blended with y^e Sulphurious Ore of Cinnabar, and of another in Germany which is blended with Zinc & Iron. —

Of Silver

It is seldom found in its Virgin State. often in a saline corroded by Muriatic Acid, when

Of Silver

it is called Luna Cornea. but never in a Californe State. It is in Ore Mineralized by, and united with Sulphur. Most Metals when united w: 2h Sulphur become friable except Silver which retains Brightness & Ductility. it is frequently disturbed with Copper, Antimony & Lead, but seldom w: 2h Iron. it is sometime found Mineralized by Arsenic.

Of Lead

It is never in a virgin State as found in the Earth: seldom or perhaps never in the Saline; sometimes in the Californe when it is called Spanish

Of Lead

which I have seen a Specimen; and frequently in a State of Ore mineralized by Sulphur, when it is called Galina. it is sometimes dispersed w^th^ Iron & Copper.

Tin

I never found here. Sometimes it is found corroded into a Crystalline Spar. Often Calciformed & mineralized by Arsenic into a Crystalline & semi-transparent Ore. —

Copper

is seldom in a virgin State; frequently in the Saline, combined w^th^ Vitriolic Acid into blue Vitriol; Sometimes in a Calciform State, but most frequently in the form of an Ore well known by y^e^ name of

Of Copper

Pyrites, which differ according to the mineralizing substances. There may be added to these, Copper & Iron, Sulphur & Arsenic. With the 1st of these is formed the Copper, with the 2nd Sulphur ores, with the 3d Arsenical Pyrites. The Pyrites are hard, friable and inflammable Bodies. Their external Surface is usually of a regularly cubical, or polygonical Shape: internally their Structure is in form of Rays diverging from a Centre. The 2nd first Species are of a deep yellow Colour, the Arsenical is white; but as these frequently unite we find Pyrites of intermediate

Of Copper

Degrees of yellow. Naturalists say ℔ 2 ℥:
when Pyrites are very hard, & crystalline
little Copper can be extracted, and also ℔ ℥:
they disagree in the air. ℥ Pyrites ℔ ℥:
contain the greatest proportion of Copper
ℏ
are those w: have a greenish cast, or
such as when exposed to the air become
covered ℔ w: blue and green efflorescences.
- yellow Ochre is a mixture of Copper and
Earth.

Of Iron.

This Metal has been thot never to ap-
pear in a Virgin State: but some
French naturalists informs us y: it is
to be found in the Saline State combined

Of Iron

It w: Vitriolic Acid into Green Vitriol. this probably gives Rise to the Calciforme Appearance when it is combined w: a certain Quantity to Reddish Ochre. In this is a remarkable Attraction be- tween this Metal & the Load Stone w: is itself a peculiar Species of Iron Ore. many Bodies w: which Iron is united conceal this Property while in its natural Condition. but if any Body be calcined w: oily or fatty matters, & then ap- plied to a Magnet, it will readily yield every particle of Iron which it contains. For the easier Calcination it will be pro- per to reduce the matter to powder. -

Of Quick-Silver

It frequently found in a pure fluid state. seldom in the saline, & never in the Calciforme. It is most generally found mineralized by Sulphur into an Ore called native Cinnabar.

Of Bismuth

It sometimes found in its native state, seldom in the saline, & often in the Calciforme. it is also mineralized by Sulphur Arsenic & frequently by Cobalt. —

Zinc

It never found pure; frequently in a saline State forming white vitriol. Often in a Calcarious when it is called Lapis Calaminaris. The Colour of this is black

Of Zinc

white or brown. Zinc cannot be united
with Sulphur, yet we sometimes find it
mineralized by other metals, the most
frequent of which is Iron. This mineral
-ized it is called Pseudo Galena.

Antimony

Was supposed never to have been found
pure; but a Swedish Naturalist has
proved that the contrary sometimes
happens. It is never in a Saline or Calci
-form State. It is most frequently found
in the State of crude Antimony, mineral-
-ized by Sulphur, & sometimes by Arsenic
When it forms a Reddish Substance.

Of Arsenic

It is never found in its native state. never in the Saline — in the Californe it pro-duces White Arsenic. It is often mineralized by Sulphur. when the latter is present in a small proportion the Ore is called Orpiment: but when there is a great proportion it is called Sandaracha, or red Arsenic. it is combined also w: Cobalt, Iron & Arsenical Pyrites. —

Of Cobalt.

well known to Enamellers on Acc.t of its blue Colour. is never found in a Virgin, or Saline, but frequently in a Calci-form State. — It is mineralized by Arsenic, & Iron, by Sulphur & Arsenic & by Iron & Sulph.r &c

Platina

Is a semimetal lately discovered, which is more ponderous even than Gold, being used for the adulteration of Gold the King of Spain in whose Dominions it was found, has prohibited the Importation of it. Specimens of it therefore are very scarce. Dr. Lewis & Mr. Scheffer have given us very accurate Descriptions and Chemical Histories of this substance.

Nihil.

has been lately discovered by the Swedes, and is not very generally known. it is said to be mineralized by various Bodies, & sometimes to assume Green and blue Efflorescences which has occasioned its being

Of Nickel

mistaken for Copper.

Of Extracting Metals from their Ores.

Metallic Bodies are not only in a State of Ore, but frequently are combined w: an Earthy or Stony Matrix. When the Ore only adheres to the Matrix we may separate it by breaking it down w: a Hammer, but when the Ore is more intimately mixed, we must powder and agitate it in a Stream of water. in Consequence of this Matrix which is generally Specifically lighter than the Ore is washed in a separate Mass to a greater Distance. This process by the Workmen is called washing: from these different States of Union w: their

Of Extracting Metals from their Ores.

Matters, has arisen the Division of Ores into Separable & inseparable.

Ores thus obtained have frequently large proportions of Sulphur or Arsenic, which under certain degrees of Heat have a power to volatilize several Metals. such Metals are distinguished by the Term Refractions. to remove in some measure this Inconvenience it is generally exposed to a Heat just sufficient to dissipate the more volatile parts Sulphur & Arsenic, which process is called Roasting. I shall not here be very minute in describing each process, but refer you to Mr Cramers Docimastica, & make

Of Extracting Metals from their Ores

a few Remarks that may render the Perusal of that Book more useful to You.

Having partially separated the Metals from their Ores, we must purify them further by the Force of Fire, and from every Additions. These Additions may be reduced to three Heads

1st. Such Additions as promote Fusion.

2nd Such as absorb or precipitate any Matters mingled with the Metallic Substances.

3d Such as prevent their Calcination, Vitrification, & Dissipation. 4th also promote a Reduction of them when calcined.

Of the first kind are all fixt Alkalies salts which very much promote the Fusion of

Metals, but most powerfully of Earthy or Stony matters. To these we may add Quick-lime, and all the Metallic Salts, which have this power in various degrees. Borax is the strongest Flux, but it is so expensive we can only employ it in small Assays. Fixed Alkalies when fused with Metals are allied with great Inconvenience, for it unites with the Sulphur or Arsenic into Alkali Sulphuris, or Hepar Sulphuris, or Hepar Arsenic. both of which especially the former are powerful Solvents for Metals. Quick-lime produces similar

Of Extracting Metals from their Ores.

Effects. Sandiver, or Fel vitri is often employed for this purpose, and is a very powerful Flux. This is a Substance skimmed from melted Glass. it is composed of the fixed Alkali & the common Salt present in the Kelp wch: is employed for making Glass; with a small admixture of Glass.

Selenites is a powerful Flux for the Earths & Stones united wth: Metals.

Calcarious & Crystalline Earths when exposed ~~to the~~ seperately to the most intense Heat will not undergo the least vitrification, but when united they become powerful Fluxes to Each other.

Of Extracting Metals fm. their Ores

Glass promotes the Fusion of Ores, but
acts more powerfully when united with
Metals, so that the Scoria of Ore Fusion
is employed as a Flux in the heat.

The Second Species of Additions for
precipitating the Bodies united with
Metals, is proper to Alkalies & Quick-
=lime, the Inconveniences of which I
have already mentioned. Metals may
be used for this purpose also, provided the
Metal added attracts the Sulphur or Ar-
=senic stronger than the Subject Metal.
We may always find a Metal proper
for the purpose by consulting the Table
of Elective Attractions. it will be serviceable
to put powdered Glass w. the mixture. -

Of Extracting Metals from their Ores.

The third Species of Additions is for preventing Calcination, Dissipation, Vitrification, and for Reducing Metals when calcined. for this purpose we may employ all unctuous & Inflammable matters. The Bill of Exchange proposes Pitch properly in a high Degree. Calcareous Earths produce this Effect.

The Communication of the Air is Absolutely necessary for y^e Calcination of Metals, so that if any Body should be interposed between the Air & Surface of the Metal, Calcination would probably be prevented. hence the

Addition of Common Salt, or rather Glass, which readily fuse & defend the Surface of the Metal from the Air.

The Chemists have invented a Mixture which answers all the purposes of every kind of Addition, this is ye Black-Flux. it is made by a gentle Deflagra-tion of two parts of Tartar & one of Nitre. in the fusion of Metals wth. this Flux, wch. only serves to Assays upon the Acct. of its Expence, the Fusion must be rendered perfect as soon as possible, & then immediately removed from the Fire to prevent Dissipation. there are several marks by wch. the perfection of

Of Extracting Metal from their Ores.

the process may be determined. if any particles of the metal remain undissolved in the Scoria, we may conclude y: the Fusion is not perfect; but if between the Scoria and the Metal a light Film be observed we may conclude y: the Heat has been too great. -

We have already given general Directions for Extracting Metals from their Ores; let us now mention those which require a particular process. -

Gold as it is generally found in a pure state may be extracted by Elliquation & Amalgation, but when combined w: other Metals, it must be treated in the

of Extracting Metals from their Ores.

general Method.

Silver When in a virgin State must be managed like gold, but when in an State of Ore it must be purified by Vitrification, or Cupellation w.th Lead. The Metal is not only the most difficult to Calcination & Vitrification of any, but also has a general power of calcining & vitrifying Perfect Metal: Substances except Gold & Silver on which it has no Effects. we may get the Silver more free from a Mixture of the Lead, or other heterogeneous Matter by Cupellation, than Vitrification, because Bodies vitrified by Lead become so very subtile in

Of Extracting Metals from their Ores

Tungsten, as readily to grasp this the most compact bodies.

Zinck-Silver being for the most volatile metal must be extracted from its Ore by Distillation w.th the addition of Iron to fix its Sulphur.

Zinc in the form of Cuda galena or Lapis Calaminaris may be extracted by distillation by the addition of powdered Charcoal to prevent Calcination.

Arsenic is most conveniently extracted in a metalline form by the addition of double portions of Alkalid Salts to prevent Fusion. it may also be obtained by Distillation w.th the addition of Iron

to fix it to Sulphur. This Method however is very imperfect. —

Of the Fusibility of Metals

M.S. are fused by various Degrees of Heat, which has occasioned this Division into Fusible, & Refractory. The incomparably the most fusable, these in Order Tin, Bismuth, Lead, Zinc Antimony, Gold, Silver, Copper, Nickel, Iron. We have not ascertained the exact Fusibility of the rest. it is certain however that Platina cannot be fused in a separate State by the Application of any Heat. the Degree of Heat which

Of the Fusibility of Metals

Metals require for their Fusion is very regular in each tho we have not been able to determine exactly as a Thermometer can not be conveniently employed. it is probable that they all acquire an equal Degree when they become red, so that we shall adopt that as a Standard. Tin Lead Bismuth & Zinc all fuse in less than a red Heat. Antimony upon the Approach of it. Gold & Silver directly after it. Copper Nickel & Iron require a Heat much greater than the red: the last of these becomes white & white coloured before Fusion. which has been called the White Heat of Iron.

We shall next mention the Changes produced upon the different Metals by the Action of

Of the Fusibility of Metals

Fire, except Gold & Silver which remain unchanged for any Space of time, in any degree of Heat which we have yet experienced. Lead & Tin suffer no Change when fused, but from the moment their Fusion begins, a considerable Calcination & Vitrification take place also. Hence we learn that in Cases where these Metals are required in a metallic State, they ought to be removed as far as possible from the Fire after Fusion. on the contrary, from & Copper suffer Calcination & Dissipation in their progress to Fusion. if therefore they be required in a calcined State, the Heat applied must not be sufficient to fuse

them: But if we want them in a Metallic State, the Fire must be raised as quick as possible. the Semimetals are still more disposed to Fusion, Calcination &c, — Wherefore they require both a sudden Accumulation of Heat, and a sudden Removal after Fusion. Quick-silver is calcined most readily at 500°: of Faren: Thermom:

Having mentioned the Fusion of Metals by Fire, we shall next consider its Effects in Calcination.

Mercury is the most easily calcined of any M. S: in which State it is called Precipitatum P. Se. Mr Homberg affirms that calcined Mercury contains $\frac{1}{100}$ of pure Gold. Next to

Of the Fusibility of Metals

Mercury, Lead is the most disposed to
Calcination, then Bismuth, Antimony
& lastly Iron. Tin tho very easily fusable
cannot be calcined, but in an extreme
Degree of Heat. in Enumerating the Pro-
-perties of M:l: upon a general Sub-
-ject, it may be taken for granted y:
the Properties of such as are omitted have
not been accurately ascertained by Experi-
-ment such is the Case both on the Subject
of Fusion & Calcination.

The next Effect of Fire upon Metals
after Calcination is Vitrification.
Gold & Silver cannot be calcined, but
when corroded by Acid Menstruums they

Of the Vitrification of Metals

may be vitrified by Heat. Lead is most easily vitrified. next in Order are Bismuth, Antimony, and Iron. Vitrified Lead in fusion is of so penetrating a Nature, that it easily pervades the most compact bodies. this is some Measure prevented by the Addition of Sand, or powdered Glass.

Having mentioned the Changes of Metallic Substances from their metalic Form to Calces & Glasses; let us next consider the Means by which their Original Texture may be restored. This is called the Reduction of Metals. This is effected by the Addition of fatty or unctuous Inflammable

Of the Reduction of Metals.

among the most powerful of which is Charcoal. Chemists suppose that the Calcin: or brittlⁿ of M: &: are occasioned by the Separation of their Phlogiston, & y: a sufficient Quantity being imparted to them by the Animal or Vegetable Soul, they again assume a Metallic form: But to Vivify this Theory we need only Observe, that Calcarious Earths when mixd with reduc M: &: as well as Charcoal or Oily Inflammables. is not the matter Separated fixt Air? —

The following Facts are Observed in the Calcination & Reduction of Metals.

Of the Reduction of Metals

that they acquire an additional weight after Calcination, notwithstanding the parts that are dissipated. if however this Calx be reduced to a Metalline State, it will be found lighter than the Mass originally subjected to ~~Distillation~~ Calcination. it is very difficult to account for these Phenomena. Some Acc^t: for the former by supposing that y^e Additi:onal weight is communicated by y^e gross parts of the Fuel, but the Exp^t: succeeds equally ~~when~~ well when the M: S: is calcined in the Focus of a Speculum, as in a Culinary Fire. Nor can this Additional weight be furnished by the Air as some have thought; for the Exp^t: succeeds as well in vacuo. —

each other

of the Relations of metals to [illegible]

All M: S. may be intimately united ex-
-cept Silver & Nihil. Iron & Lead. Arsenic
& Platina. Cobalt & Nihil. add to these
Exceptions Zinc & Bismuth w: unite w:
Iron. Bismuth & Nihil do not unite
alone, but if Cobalt be added a union
of the three takes place. most M: S. are
very brittle, just as they begin to con-
-crete after Fusion, by breaking therefore
& examining the internal Structure we
may see when the parts of the same kind M:
Substance are sufficiently blended. Other-
-wise it is very difficult to determine.

The white M: S. change the Colour of
the others, more than in proportion to y.

Quantities added. Thus a small portion of Arsenic discharges the yellow Colour of a large quantity of Copper.

The Combinations of Sn. S. serve for various purpose of Art. E.g: the Goodness of Speculums depend upon y^e polish they receive, we also know that y^e finest polish can be imprest upon that Substance which is most brittle, and at the same time most dense and of the closest Texture. Such a Substance we must endeavour then to get for a Speculum. But it also will require One least acted upon or corroded by the Air. The Combination of Arsenic & Copper has been employed for this

purpose on acc.^t of its Brittleness & light Colour; it is however very readily corroded and tarnished by the Air. y^e French Chemists say y.^t a Combination of Gold & Zinc possesses the properties required more perfectly than any yet invented.

Other purposes of Art require y^e most sonorous Bodies possible as the making of Bells. As Bodies become sonorous in proportion to their Density & Elasticity, we must therefore chuse a Compound w.^{ch} will possess these properties most perfectly. perhaps Ordonnance requires a Matter of this sort. Every Mixture of M.^{ls}

Of the Relations of Metals &c

diminishes their Malleability. a small Quantity of Tin destroys y^e^ Malleability of a great proportion of Gold. y^e^ Fusibility of M.S. is very much encreased by Mixture. For Example 2 parts of Tin 3 parts of Lead & 5 of Bismuth when mingled may be fused w^th^ the Heat of boiling water. Hence Anatomists have been extremely anxious to get a M.S. sufficiently fusible for Injections, by that means obtaining perfect Models of the human Blood Vessels. But y^e^ before mentioned Compound is unfit for this purpose, because y^e^ boiling Heat which is necessary for its Fusion destroys y^e^ small Ramifications. y^e^ Divisibility

may be sufficiently encreased by ♃ but, it renders it also very brittle, so as to be intirely unfit for the purposes intended.

The Combination of ☿ w:th M: S: is called Amalgation. Gold, Lead, Tin, Bismuth Zinc unite w:th ☿ at a boiling heat if pow-dered. the practise of powdering is only required for Gold. the rest may be united by adding them hot to the boiling Mercury. Silver & Mercury may be united if the former is suspended in dilute ⊕r, and the latter added in a proportion large eno' to saturate the acid, & dissolve the silver. Luna Cornea w:th ☿ may be formed

Of the Relation of Metals.

by precipitating Silver from ⊖ ♂ w: ⊖ ♂ the when united with vol: Alkali produces an Ammon: ^l w:^ch unites w: the ☿ & y^e Silver may be extracted very pure from y^e Combination.

To unite Copper & Merc^y we must take the former in the State of Orugo Oris dissolve it in vinegar — put y^e Solution into an Iron pan w: the Mercury — apply it to the Fire stir the mixture w: an iron Ladle till they are united, & then pour off the vinegar: this may be done w: the Glass vessels by the Addition of Iron w:^ch attracts the Acid more strongly than the Copper. this Compound is fusable

nearly at the boiling point & by freq: Repetitions of the process, the Copper assumes the Appearance of Gold. to unite Mercury & Antimony we must heat them in Separate Crucibles, then put y^m together, & use Triture. The Mercury obtained from this mixture is very fine & less liable than formerly to be turned into a black powder. Bismuth unites w^th Mercury, & disposes it also to unite w^th Other M.S. — In all Combinations of m.S. the weight of the Compound is greater or less, & often equal to y^e Sum of the mixed. so y^e famous Proposition of Archimides for determining y^e Quantity

of Alloy in a Metal will not be universal-
-ly true.

The Separation of M.S. from each other
may be best known from their Chemical
History and Elective Attractions. we shall
only mention how the most precious metals.

Gold may be separated from all M.S.
by an Amalgation w. Mercury to which
it has a stronger attraction than any
other M.S. — Gold may be separated
from all M.S. by Antimony. for this
has a power of Volatilizing all except
Gold. If Ether is added to a Solution of
Gold in Aqua Regia the Metal will be
suspended in a Liquate State between
the Ether & Menstruum. it may be also

separated from Silver by Sulphur which unites w:th the latter only. Gold may be separated from Silver by Aqua Regia when we would dissolve the Gold, or by Nitrous Acid when we would dissolve the Silver. when we employ y^e latter it will be necessary for a complete so:lution that there sh:d be 3 parts of Silver to 1 of Gold. The Scoria of Lead employed for extracting Gold & Silver is called Litharge. Silver may be separated by Corrosive Sublimate; or by adding Glass of Lead in Cupellation w:ch vitrifying the Tin also carries it thro' the Cuppel, & leaves the Silver pure. It is best separated from

Of the Separation of Metals &c

Copper by Digestion... Gold & Silver cannot be separated from ye menstruum by Caustic vol: Alkali, but all other M. S. may: nor can they be calcined in De: flagrations with nitre, wch calcine all the other M. S: for a separation of the baser metals. I wd: recommend to yr: Perusal the Directions given in Cramer's excellent Treatise of the Ars Docimastica. As to ye: particular Relations of M. S. to Pharmacy & Medicine I shall leave it to ye Pharma= ceutical Chemistry, & proceed to ye next Class of Bodies the Earths. But before this I shall subjoin a Table of ye propor: tions of the Specific Gravities of Metallic Compounds to ye Specific Grav: of ye Bodies before mixture.

Table.

1	2	3
☉ + ♄	☉ + ♑	☉ + ♀
☉ + ☽	☉ + ♌	☉ + ♂
☽ + ♄	☽ + ♑	☉ + ♃
☽ + ♀	☽ + ♌	♄ + ♀
☽ + ♃	☽ + ♋	♄ + ♃
♀ + ♃	♀ + ♌	♂ + ♌
♄ + ♀ + ♃	♀ + ♋	♂ + ♑
	♃ + ♑	♂ + ♋
	♄ + ♌	♃ + ♌
	♄ + ♑	♃ + ♋
	♄ + ♋	♌ + ♋
	♑ + ♋	
	☽ + ☿	

Of Earthy Bodies

Earths are distinguished from y^e^ other Classes of Bodies by the following Marks. They are invisid dry solid Substances not soluble in water, not inflammable, not easily fused in the Fire, & if fused do not convert in their Original Form, but remain vitrified. This Definition comprehends both Earths & Stones.

Earths according to M^r^ Pott are Absorbent Crystalline Argillacious & Gypseous. but for Reasons before given the latter are properly Saline Bodies, & in the place of them I would substitute the Talky. So y^e^ sh^d^ divide them into 4 principal Genera.

Of Earthy Bodies

viz: Absorbent, Argillaceous, Crystal-
=line & Salthy.

Mr Cronstadt has enumerated 9 kinds
of Earth 1st Calcarious, 2nd Silicea, 3d Gra-
=natea 4th Argillacia, 5th micacea 6th Schor
7th Asbestina & Zeolites, 9th magnesia. These
are however reducible to the Divisions
we have adopted. his Calcaria are a species
of Absorbent. his Silicea & Granatea are
& Crystalline. they are fusible, but y: is
nothing to the M. I. 72 w: which they are gene-
=rally combined. we know also y: M. I: ren-
=der Crystalline Earths fusable. Gypseous
Bodies contain his Alcaria, whose
Fusibility like the Gypseous depends

of Earthy Bodies

upon the Structure of Other Earths. it is yet doubtful whether his Zeolites are a peculiar Earth or Only a Mixture. his Argillaceous are the same as Ours. his Micaceous & Asbestina are probably Earthy. his Magnesia is not very well known, but it is probably a Mixture.

Absorbent Earths

The distinguishing Properties of these are as follows. They effervesce with Acids readily soluble in Acids. They are never hard enough to strike fire with Steel. if powdered & mixed w. water they do not acquire viscidity or harden in the Fire. they may be divided into 4 general Species i. the Calcareous.

Of Absorbent Earths

properly so called, or such as by Calcinat-
-on are convertable into Quick lime.
2nd Magnesia Alba. 3d Earth of Alum
or the Lohble part of Clay, 4th The Earth
obtained from the Calcination of Animal,
& perhaps Vegitable Substances.

I shall only treat of the first 3 Species,
referring you for the other Species to the
Authors who have given the best Acc.t of
them. Thus for the Earth of Alum to Mr.
Margraaf. for the Magnesia & Animal
Earth. to Dr. Black's Treatise in 4.to Physical
& Literary Essays. —

Calcarious Earths

This Species of Absorbents are of more importance than any other both in Arts and Medicine. They are found under various Appearances either in Strata or in loose nodules dispersed among other Matter, or in a Crystalline hard mass called Spar. in this State they are often mistaken for Concretions of the Crystalline Earths. they may be however commonly distinguished by the following marks. Spars when broken are in Rhomboidal Fragments, & if held to the light the mass seems to be compound of such Fragments.

Calcarious Earths form Concretions of various Degrees of Purity & Firmness.

Calcarious Earths

Such are Common Chalk whose texture is shivery, and its particles impalpable — the finest marbles and lastly the roughest Limestone all belong to this Sp.

This Species likewise includes the Stalactite which are very frequently to be met with in Caves investing various Substances, & sometimes to the Roots of plants giving occasion to the production of the famous Osteocolla. in short Petrifactions always produce Calcarious matter, as do the Shells of all Animals, all Coral, Fungi Lapidei &c. may perhaps all kinds of Calcarious Earths are animal productions.

of Calcareous Earths

Calcareous Earths appear also under various forms of Marle. The Shells of Animals when they loose their Texture by long time form wt is called Testaceous Marle. When this Earth is mixed wth Clay it forms the Marle distinguished by the Term Clayey.

Calcareous Earths are employed either in a Solid State, or dissolved in Acids for various purposes in Medicine & Arts. I shall however speak chiefly of its use wth Regard to the latter.

It is generally employed as a Manure for Land, either combined wth Clay into a Marle or in the form of Testaceous

Of Calcarious Earths

Marle, or as obtained by calcination from Lime Stone or Marble. Chalk has been also employed w.ch succeeds, but in such places as have the Calcarious Earth in no other form but those of hard concretes. They have been entirely disused of late as a manure the practice was introduced of reducing Limestones & or Marbles to a powder by a particular machine, in w.ch state they become dissolvable, and equally fit for manuring w.th the other kinds.

Having examined in w.ch manner they are employed let us next consider in w.ch


HEM
2